NUCLEAR SCIENCE ABSTRACTS

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GENERAL AND MISCELLANEOUS

4969 BNL-564

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] APRIL 1–JUNE 30, 1959. Nov. 1959. 77p. OTS.

Progress in unclassified research is outlined. Abstracts are given for research activities being reported concurrently in scientific journals. Progress is reported in physics, cosmotron development, accelerator development, chemistry, reactor research, nuclear engineering, and biology and medical research. (For preceding period see BNL-550.) (J.R.D.)

4970 ITR-1715

Stanford Research Inst., Menlo Park, Calif. and Office of Naval Research, Washington, D. C.

AIR AND GROUND INSPECTION TECHNIQUES FOR THE DETECTION OF UNDERGROUND EXPLOSIVE TESTS. Preliminary Report. R. M. Foose and R. B. Hoy. Project 26.14 [of] OPERATION HARDTACK II. Jan. 5, 1959. Decl. Nov. 2, 1959. OTS.

Aerial-photographic, surface, and underground investigations were made before and after selected test shots during Operation Hardtack to assist in defining appropriate and effective procedures for the location of clandestine underground nuclear explosions. Results of six underground explosions are evaluated. Data and photographs are presented. Reconnaissance photography at 1:20,000-scale, with 60-per cent endlap and 40-per cent endlap, proved highly satisfactory for regional information of gross patterns and accessibility. Detailed aerial photography proved invaluable as a basis for rapid mapping of detailed fracture patterns or other significant terrain features. Surface and underground inspection methods were less satisfactory. (C.H.)

4971 MSAR-59-136

MSA Research Corp., Callery, Penna.

PROGRESS REPORT NO. 55 FOR OCTOBER AND NOVEMBER 1959. W. J. Posey, ed. Dec. 16, 1959. 21p. Contract NObs-77023.

Engineering. Experiments on the chloride stress corrosion of austenitic stainless steel were terminated. An investigation was started on the corrosion of Inconel piping exposed to a simulated sea water-air environment. A proposal to study the effect of temperature gradient between the top and bottom of the BTF pressurizer was submitted. In the pressure buildup in vapor container during loss of coolant accident, a run was made to study the effect of increasing the surface within the containment vessel. Chemistry. The mode of meltdown and characteristics released and distribution of fission products were studied to provide safeguard information for pressurized water type plants. The reaction rates of sodium sulfite and dissolved oxygen in boiler water and feed water are being studied as a function of temperature, oxygen concentration, sulfite concentration, phosphate concentration, pH, and copper concentration. The experimental work on $K_2B_4O_7$ as a chemical poison for reactor shutdown was completed. A proposal of decontamination studies was prepared and submitted. (For preceding period see MSAR-59-117.) (W.L.H.)

4972 NP-8132

California. Univ., Berkeley. Inst. of Engineering Research.

PROGRESS REPORT ON THE SAMPLE SURVEY OF SHELTER AREAS. D. W. Barker and D. J. Sundblom. Feb. 2, 1959. 40p. Contract CD-SR-58-40.

A pilot study was made of shelter areas in a census tract in Richmond, California. Residential structures in the tract were enumerated and a sample of 300 structures was selected at random and individually photographed. Data obtained on each house included a rough sketch of the exterior wall plan, a simple description of the building materials used, the shape of the roof, the presence of fireplaces and basements, total floor area, and age of building. A statistical study was made of the suitability of the structures as fall-out shelters. Appended is a discussion of the statistical problem in detail. (C.H.)

4973 NP-8228

Denmark. Atomenergikommissionen, Roskilde.

REPORT ON THE ACTIVITIES OF THE DANISH ATOMIC ENERGY COMMISSION FOR THE PERIOD FROM APRIL 1, 1958 TO MARCH 31, 1959. Nov. 1959. 83p.

In the past year the AEC carried on the activities begun when it was established. The construction of the Risø Research Establishment continued and technical and scientific research commenced at the Establishment. DR-2 reached criticality on Dec. 19, 1958. Building operations in the fiscal year 1958-59 were devoted especially to the construction of the buildings required for the DR-3 Reactor. Training, agricultural research, and prospecting were continued. (W.D.M.)

4974 TID-5001(3rd Rev.)

Technical Information Service Extension, AEC.

SUBJECT HEADINGS USED BY THE USAEC TECHNICAL INFORMATION SERVICE. Charles W. Hargrave, ed. Jan. 1960. 482p. OTS.

4975 WT-367

Armed Forces Special Weapons Project. Field Command, Albuquerque, N. Mex.

BLAST AND SHOCK MEASUREMENT. II. CLOSE IN GROUND MEASUREMENTS. William F. Gannon. Mar. 1952. Decl. Sept. 16, 1959. 231p. Project 1.2b [of] OPERATION JANGLE. OTS.

At the time of the JANGLE underground shot the rate of progression of the underground wave was measured. In addition, an attempt was made to record the rate of expansion of the fireball and the point of break-away of the shock front from the fireball. In obtaining close-in measurements of blast phenomena, recording is difficult because of ionization in cables produced by gamma radiation and electrical differences in potential set up by ground currents produced at the time of detonation. To overcome these difficulties and derive a suitable system, several methods were considered, tested, rejected, or modified. The two methods finally decided upon were the normally closed thyratron switch and the normally open thyratron switch. For the first method a diaphram-actuated switch was developed, the opening of which removed a fixed bias on a thyratron tube, permitting it to conduct. The switch for the second method was basically the same as that for the first except that the action of the diaphram closed the switch and shorted out the bias on a thyratron tube, causing it to conduct. The results of the close-in ground measurements showed that, for the first few feet, there was a very large expansion with a velocity of the order of 10^5 feet per second. From 25 to 100 feet the velocity was approximately 2700 feet per second. During the second hundred feet the average velocity was reduced to 2500 feet per second. Beyond 200 feet the velocity increased to more than 4000 feet per second. Although the time of arrival data presented is subject to correction, the tests have definitely proved that the velocity of a shock wave traveling through the earth can be measured by using a closed-diaphram switch in conjunction with a thyratron-pulsing circuit. As pointed out in the body of this report, the chronograph employed is subject to improvement. (auth)

4976 WT-368

Naval Ordnance Lab., White Oak, Md.

BLAST AND SHOCK MEASUREMENTS. III. TRANSIENT GROUND DISPLACEMENT MEASUREMENT. W. E. Morris. [1952]. Decl. Sept. 16, 1959. 249p. OTS.

An attempt was made to measure the transient ground displacement for the surface and underground shots of Operation JANGLE. The method of high speed photography of the ground motion is described. Negative results were obtained for both the surface and underground shots. This method does not appear promising for any future nuclear surface tests. With good photography, this method has considerable promise for underground nuclear explosions and is recommended for future tests. (auth)

4977 WT-391(Del.)

Technical Operations, Inc., Arlington, Mass.

PREDICTED SCALING OF RADIOLOGICAL EFFECTS. M. G. Schorr and E. S. Gilfillan. June 15, 1952. Decl. with deletions Sept. 15, 1959. 114p. Project 2.0 [of] OPERATION JANGLE. OTS.

The radiological contamination which may result from fission bombs detonated near the surface of the earth and underground is predicted. The radiation received is primarily a result of the initial radiation from the early fission products and fall-out of radioactive material from the high cloud. The distribution of the fall-out is determined by constructing a mathematical model and adjusting the parameters of the model to fit actual JANGLE data. The model is then scaled up to larger weapons by scaling these parameters in conformity with existing formulations of explosion cloud dynamics. The initial radiation is calculated in a straightforward manner. The resulting dose and dose-rate contours are given, as are the areas enclosed by given contours. It is concluded that the base surge at the JANGLE underground explosion did not contain an appreciable amount of radioactive material. The cratering action of explosives is discussed, and it is found that atomic bombs exploded near the earth surface should give crater radii which scale as the one-sixth power of the energy release rather than the one-third power scaling applicable to high explosives. (auth)

4978 WT-1495

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

CLOSE-IN TIME-OF-ARRIVAL MEASUREMENTS FOR YIELD OF UNDERGROUND RAINIER SHOT. D. C. Anderson and F. B. Porzel. July 1959. 174p. Project 25.1 [of] Operation PLUMBBOB. OTS.

An investigation was continued on the hydrodynamic variables which contribute to an understanding of the phenomenology of underground explosions. Measurements were made of the total energy released and energy partition at various interfaces following the detonation of Rainier Burst. Theoretical background is discussed and test procedures are described. (C.H.)

4979

PRACTICAL CONSIDERATIONS OF AN ION PROPULSION SYSTEM. A. E. Lennert (Martin Co., Baltimore). Applications and Ind. No. 45, 326-32(1959) Nov.

A parameter study of an ion propulsion system for driving a 20,000 lb vehicle into space, where the power source stems from the direct conversion of nuclear to electric energy, is presented. Cesium and potassium are compared as the propellant. A comparison is presented of the space propulsion systems of chemical, photon, solar, radioisotope, and plasma rockets. (C.J.G.)

4980

OPTIMAL ACCURACY ROCKET TRAJECTORIES. George A. Baker, Jr., Kenneth W. Ford, and Charles E. Porter (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 30, 1925-32(1959) Dec.

The rocket optimization formulation of B. D. Fried is modified slightly to facilitate the study of maximum accuracy trajectories. Various illustrative special solutions are obtained, particularly perturbation results valid for small thrust. For surface-to-surface rockets in a Kepler field, optimal thrust programs are obtained numerically, their accuracy is studied quantitatively, and comparison of range and of accuracy is made with rockets using a constant-angle thrust program. Optimization leads to only a slight increase in range but to a substantial gain in accuracy. The possible application of rocket optimization methods to the focusing of charged particles is also suggested. (auth)

4981

ATOMIC POWER AND ENERGY RESOURCE PLANNING. Bureau of Business Research Monograph Number 94. Richard A. Tybout. Columbus, Ohio, Ohio State University, 1958. 98p.

World energy sources are discussed relative to the adequacy of coal, oil, and gas reserves. Estimates for energy needs of the world are projected to the year 2000. Commercial uses of nuclear fuels in the United States and the nuclear potential in other countries are discussed. Public programs for the promotion of private atomic power in the United States are discussed. An evaluation of present policy relative to energy needs, atomic capabilities, and traditional relationships between Government and private enterprise in the American economy is presented. (C.J.G.)

BIOLOGY AND MEDICINE

General and Miscellaneous

4982 BNL-558
Brookhaven National Lab., Upton, N. Y.
STRUCTURE AND FUNCTION OF GENETIC ELEMENTS. REPORT OF SYMPOSIUM HELD JUNE 1–3, 1959. Brookhaven Symposia in Biology No. 12. 191p. OTS.

Topics discussed at this symposium include the structure of nucleic acids, biochemical activities of nucleic acids, genes, genetic transfer by viruses, the structure and duplication of chromosomes, and nuclear-cytoplasmic relationships. Complete author and subject indexes are included. Separate abstracts have been prepared on the 14 pages presented. (C.H.)

4983 BNL-558(p.1-16)
Harvard Univ., Cambridge, Mass.
THE HETEROGENEITY IN PROPERTIES AND FUNCTIONING OF DEOXYRIBONUCLEIC ACIDS. Paul Doty, Julius Marmur, and Noboru Sueoka. 16p.

Topics discussed include thermal transition in desoxyribonucleic acids (DNA); the relation of denaturation temperature to molecular composition; estimation of heterogeneity from absorbance-temperature curves; the relation of density to molecular composition; the relation of DNA composition to protein composition; the thermal inactivation of biologically active DNA; and the fractionation of some genetic markers. (C.H.)

4984 BNL-558(p.17-26)
Massachusetts Inst. of Tech., Cambridge.
POLYNUCLEOTIDE INTERACTIONS AND THE NUCLEIC ACIDS. Alexander Rich. 10p.

The current status of research on the synthetic polyribonucleotides is reviewed. The relevance of this work to the study of naturally occurring nucleic acids is discussed. (C.H.)

4985 BNL-558(p.27-34)
California Inst. of Tech., Pasadena.
A SINGLE-STRANDED DNA FROM BACTERIOPHAGE ϕX174. R. L. Sinsheimer. 8p.

A single-stranded form of DNA is described which was found in a bacteriophage. Properties of the DNA and of the phage are discussed. It is concluded that the bacteriophage is an example of a new class of viruses. The biochemistry of infection by such a virus is discussed. (C.H.)

4986 BNL-558(p.35-9)
Gt. Brit. Medical Research Council. Unit for [Research on the Molecular Structure of Biological Systems], Cavendish Lab., Cambridge.
THE PRESENT POSITION OF THE CODING PROBLEM. F. H. C. Crick. 5p.

The relationship between the amino acid sequence of a particular protein and the sequence of the bases in some particular length of nucleic acid is discussed. The problem of translating from one language to another, or from the 4-letter language of the nucleic acids to the 20-letter language of the protein, without any detailed consideration of the chemical processes involved, is referred to as the coding problem. Applications of information theory in an analysis of ribonucleic acid and desoxyribonucleic acid composition are considered. Experimental facts are reviewed which are not explained by the code or by the theory. (C.H.)

4987 BNL-558(p.40-6)
Massachusetts. General Hospital. John Collins Warren Labs., Boston.
THE PRESENT STATUS OF THE ADAPTOR HYPOTHESIS. Mahlon B. Hoagland. 7p.

Problems are reviewed which are involved in designing codes whose symbols represent the language of protein. Possible chemical mechanisms involved in translating this code are considered. The adaptor hypothesis is stated and discussed. This hypothesis states that amino acids, before entering the ribonucleoprotein particle, first react chemically with specific small polynucleotide molecules. These adaptor molecules accompany the amino acids into the particles and are responsible for properly locating them on the particle RNA. This is accomplished by pairing of the adaptor's bases with complementary base sequences on the particle RNA. Having completed their mission, the adaptors then return to the soluble milieu. These steps are depicted schematically. (C.H.)

4988 BNL-558(47-62)
Gt. Brit. Medical Research Council. Biophysics Research Unit, King's Coll., London.
DNA MEDIATION IN PROTEIN SYNTHESIS. G. L. Brown, A. V. W. Brown, and J. Gordon. 16p.

The role of DNA as the main carrier of genetic information is examined from the standpoint of biochemical pathways by which information is conveyed to the functional structures actively involved in the synthesis of proteins. Results are presented from a series of studies on the T2 bacteriophage infected Escherichia coli system. Data are presented on the organization of germinal material of the T2 bacteriophage, phage protein synthesis in disrupted protoplasts, and the role of low molecular weight RNA in protein synthesis. (C.H.)

4989 BNL-558(p.63-75)
Harvard Univ., Cambridge, Mass. Biological Labs.
ON THE MOLECULAR EXPLANATION OF SPONTANEOUS AND INDUCED MUTATIONS. Ernst Freese. 13p.

The molecular basis of heredity is discussed from the standpoint of the molecular structure of the genome in which most hereditary determinants, or genes, are one-dimensionally arranged. Recent observations indicate that the hereditary information is determined by DNA while other molecules, including proteins, keep the DNA molecules together and in the right sequence. An analysis is presented of genetic fine structure due to the molecular properties of DNA. Topics examined include the extent of mutations, mutagenic selection rules, and mutation probabilities. Results are reported from a series of studies on mutants of T4 bacteriophage. Possible causes for mutagenic specificity are discussed. (C.H.)

4990 BNL-558(p.76-85)
Massachusetts Inst. of Tech., Cambridge.
GENETIC AND CHEMICAL STUDIES WITH ALKALINE PHOSPHATASE OF E. COLI. Cyrus Levinthal. 10p.

Results are reported from studies using the enzyme alkaline phosphatase of E. coli strain K 12 to investigate the genetic control of proteins. The linearity of the amino acid sequence of a polypeptide chain is considered the most likely structural feature of a protein to be determined by the linear order of nucleotides in DNA. Topics discussed include the purification and properties of alkaline phosphatase; the isolation and characterization of mutants, and the mapping of phosphatase negative mutants of K 12 strain E. coli. (C.H.)

4991 BNL-558(p.86-94)
Gt. Brit. Medical Research Council. Unit for [Research on the Molecular Structure of Biological Systems], Cavendish Lab., Cambridge.
GENETIC AND CHEMICAL STUDIES ON THE HEAD PROTEIN OF BACTERIOPHAGES T2 AND T4. S. Brenner and L. Barnett. 9p.

The theory of gene action is considered from the point of view of the hypothesis that the nucleic acid of a gene contains a coded sequence of nucleotide bases which specifies the amino acid sequence of the protein determined by that gene. Results are described from experiments which show that it is possible to obtain and map mutants which very probably affect the primary structure of the head protein of bacteriophages. The genetics of osmotic shock resistance in bacteriophage, the effect of mutations on the amino acid sequence of the head protein, and rescue-recombination experiments to establish the relation between mutants and head protein in bacteriophages are discussed. (C.H.)

4992 BNL-558(p.95-102)
Massachusetts Inst. of Tech., Cambridge.
GENETIC TRANSFERS BY VIRUSES. S. E. Luria. 8p.

Viruses are defined as elements of genetic material associated with specific devices for their transfer from cell to cell, the complete structures being recognized as virus particles. The essential genetic material of viruses is mainly nucleic acid, consisting of desoxyribonucleic acid in bacteriophages and in some animal viruses, and ribonucleic acid in other animal viruses as well as in all plant viruses so far analyzed. Therefore, all infections of cells by viruses are considered genetic transfers. Distinctions between direct genetic action and indirect effects of a virus, genetic functions of bacteriophage, mechanisms of transduction by bacteriophage, and the hypothesis of transduction and conversion are discussed. (C.H.)

4993 BNL-558(p.103-24)
Brookhaven National Lab., Upton, N. Y.
A COMPARATIVE VIEW OF THE CHROMOSOME. Dale Steffensen. 22p.

Chromosomes are defined as highly organized structures which transmit the heritable material from one generation to another. An attempt is made to compare and integrate evidence about chromosome structure which was gathered from a number of sources. Some effort is made to connect the knowledge about chromosomes obtained from cytological studies with recent findings concerning macromolecular organization. Detailed evidence is included on the role of divalent metals in chromosomes and the replacement effects of various cations in chromosome stabilization. Results are reported from studies on Tradescantia. Autoradiography was used to study the retention of calcium-45 or strontium-90 in the nuclei of plants. Topics discussed include the occurrence of multistranded chromosomes, the various kinds of bonds between the macromolecules of chromosomes, chromosome breakage and the role of metal ions, effects of temperature on chromosome fragmentation, calcium-45 inclusion in nuclei, and the retention of divalent metals by habrobracon sperm. (C.H.)

4994 BNL-558(p.125-33)
California Inst. of Tech., Pasadena. Norman W. Church Lab. for Chemical Biology; California Inst. of Tech., Pasadena. Gates and Crellin Labs. of Chemistry; and Roswell Park Memorial Inst., Buffalo.
MODIFIED DENSITY OF TRANSDUCING PHAGE LAMBDA. J. Weigle, Matthew Meselson, and Kenneth Paigen. 9p.

The bacteriophage lambda is a long-tailed DNA virus which infects strain K 12 of Escherichia coli. Depending in part upon the physiological conditions attending infection, one of two quite different courses of events may follow. The virus may multiply about 100-fold, bringing about the lysis of its host cell or, instead, the cell may become lysogenized. In the latter case, the virus establishes a stable relation with the host cell and in this state is called a prophage. The prophage multiplies in synchrony with its host so that lysogenized cells may be propagated for many generations without loss of the prophages they harbor. Properties of the transducing phage are described. (C.H.)

4995 BNL-558(p.134-52)
Chicago, Univ. Whitman Lab.
STUDIES ON NUCLEAR FINE STRUCTURE. Hewson Swift. 19p.

Genetic evidence is reviewed which indicates that nucleus and cytoplasm continually exchange materials during growth and repair. Results are reported from electron microscopic studies of cell fine structure and mechanisms of transfer at the macromolecular level. It is concluded that RNA is associated with a variety of particulate components in the nucleus, the chromosomes, and areas between the chromosomes. (C.H.)

4996 BNL-558(p.153-74)
Brookhaven National Lab., Upton, N. Y.
RNA IN NUCLEAR-CYTOPLASMIC INTERACTION. Philip S. Woods. 22p.

Results of recent studies on the structure and function of genetic elements are reviewed. Improved methodology in the various fields of study is credited with recent advances. Autoradiography contributed toward elucidation of the problem of chromosome duplication. Circumstantial evidence indicates that ribonucleic acid (RNA) is involved in some way in protein synthesis. Recent attempts at studying the metabolism of RNA as it relates to intracellular morphology are reported in which the autoradiographic method was used in conjunction with RNA precursors labeled with tritium. (C.H.)

4997 NYO-2784
Columbia Univ., New York. Radiological Research Lab.
ANNUAL REPORT ON RESEARCH PROJECT, July 1, 1959. 200p. Contract AT-30-1-Gen-70. OTS.

A list of publications during the period is included. Progress is reported in the following studies: measurements of tissue dose of fast and slow neutrons and high-energy particles; the development of proportional and Geiger-Mueller counters with tissue equivalent walls; measurement of tissue dose in brain tumors containing boron and irradiated with slow neutrons; measurements of beta-ray dose employing gas multiplication; mechanisms of spontaneous and radioinduced mutations in E. coli; statistical fluctuation in the energy loss of alpha particles; the development of ionization chambers to measure the ratio of absorbed dose to exposure dose; the development of cavity ionization chambers for use as dosimeters; measurements of the relative stopping power for beta particles in air and water vapor; measurement of absorbed dose from x rays in the interface between bone equivalent and soft tissue equivalent materials; measurements of surface and depth doses delivered by a silver-111 coated ruber balloon catheter; the effects of vitamin B-12 on irradiated rabbits; the homotransplantation of spleen in rats; the effects of cysteine on the immune mechanism in irradiated rabbits; effects of irradiation on aging and mutagenesis in rotifers, microscopic aquatic metazoa, and in Drosophila; the development of procedures for spray application of a lead paint used to provide additional shielding for low-voltage x-ray machines and x-ray darkrooms; and the design of a tissue equivalent ionization chamber for radiation measurements. (C.H.)

4998

EFFECT OF SENSITIZING AND PROTECTING COMPOUNDS IN ROENTGEN IRRADIATION OF LYMPHOCYTES IN VIVO. G. H. Hjort. (Univ. of Cambridge, Eng.). Acta Radiol. 52, 406-12(1959) Nov. (In English)

Attempts have been made to influence lymphocyte radiosensitivity by administering radio-protecting or radio-sensitizing compounds prior to whole-body irradiation in rats. Cysteine produced a slight protective effect and a doubling of the latent period; cysteamine gave a threefold increase in the radioresistance of the lymphocytes. Synkavit given in doses capable of producing sensitizing effects on tumor tissue failed to cause any changes in the radiosensitivity of the lymphocytes. (auth)

4999

RESISTANCE TO WHOLE-BODY X-IRRADIATION IN RATS MADE TOLERANT TO BACTERIAL ENDOTOXINS. B. W. Zweifach, E. Kivy-Rosenberg, and Arnold L. Nagler (New York Univ.–Bellevue Medical Center, New York). Am. J. Physiol. 197, 1364-70(1959) Dec.

Rats were treated with three conditioning agents (bacterial endotoxins, zymosan, and compound 48/80) known to produce tolerance to other forms of stress, as a means of determining the importance of the reticulo-endothelial system in the response to whole-body irradiation. Effective protection was provided by tolerance induced by lipopolysaccharide extracts of E. coli bacteria. Some protection was also afforded by conditioning with 48/80 for several days. These agents were active only when administered before exposure to x rays. Treatment post x-ray broke down the induced resistance. Blood platelet levels remained high in conditioned animals exposed to WBR. It is suggested that a relationship exists between the priming or conditioning of the reticuloendothelial system and the maintenance of satisfactory blood platelet levels in adapted animals receiving WBR. (auth)

5000

ASPIRATION BIOPSY: TECHNIQUE AND APPLICATION. John T. Godwin (Brookhaven National Lab., Upton, N. Y. and Memorial Center for Cancer and Allied Diseases, New York). Ann. N. Y. Acad. Sci. 63, 1348-73(1956) Mar. 30.

A review is presented on the techniques and applications of aspiration biopsy. Photographs of cells taken from various lesions are given. (C.J.G.)

5001

TREATMENT OF MULTIPLE MYELOMATOSIS WITH PARTICULAR REFERENCE TO RADIOACTIVE IODINE. REPORT OF FIVE CASES. H. E. M. Kay, E. M. Ledlie, and R. C. Sbresni (Royal Marsden Hospital, London). Brit. J. Radiol. 32, 791-7(1959) Dec. (In English)

Five patients suffering from multiple myelomatosis have been treated with radioactive iodine at some stage of the disease, as a method of total-body irradiation. Thyroid uptake was blocked in each instance with Lugol's iodine. Iodine-131 has been used in the form of iodide three times, and in the form of iodinated human serum albumin six times. Relief of generalized pains for periods up to three months was obtained on two occasions after treatment with I^{131} as iodide, and in two other patients after treatment with I^{131}-H.S.A. In the fifth patient relief of pain and hematological remission for over a year followed local x-ray treatment to a collapsed vertebra combined with an injection of I^{131}-H.S.A. No response was obtained to a second dose of iodine in any patient. The biochemical findings were practically unchanged and the anemia associated with the disease was not affected by radioiodine therapy. The method seems worthy of further trial in conjunction with other methods, particularly in patients with early disease. (auth)

5002

RADIOACTIVE STRONTIUM AND CAESIUM IN THE EDIBLE PARTS OF CROP PLANTS AFTER FOLIAR CONTAMINATION. L. J. Middleton (Agricultural Research Council, Grove, Berks, Eng. and Field Station, Compton, Berks, Eng.). Intern. J. Radiation Biol. 4, 387-402(1959) Oct.

The degree of contamination of wheat, potato, cabbage, and sugar beet has been investigated after the application of Sr^{89} and Cs^{137} in a fine spray at different stages in the growth of the plants. The main experimental treatments were applied over two years to obtain information on seasonal effects. The extent to which Cs^{137} was concentrated in the edible tissues greatly exceeded that of Sr^{89}. Usually the concentration of Sr^{89} or Cs^{137} in each crop varied by less than an order of magnitude irrespective of the state of growth of the crop at the time of contamination and the year in which the experiment was carried out; the Sr^{89} content of wheat grain, however, was considerably lower when the plants were contaminated before the ears emerged. A large part of the radioactivity which was deposited on the leaves was removed rapidly by rain; a further fraction was lost as leaves died. The data obtained have been used to predict the probable degree of contamination of crops growing under normal agricultural conditions. (auth)

5003

EVALUATION OF RADIO-PROTECTIVE EFFICACY OF CYSTEAMINE (WITH RAT-LIVER-CELL GLYCOGEN AS REFERENCE SYSTEM). R. Chatterjee, A. Bose, and P. De (Chittaranjan National Cancer Research Centre, Calcutta). Intern. J. Radiation Biol. 4, 420-4(1959) Oct.

A technique for localization of glycogen in the hepatic-cell cytoplasm of rats was utilized for determination of the radio-protective efficacy of cysteamine with 15 mg dose per animal. Radiation-induced glycogenesis was at its maximum peak 24 hours after irradiation with 300 r, 500 r, and 800 r. After irradiation with 500 r, protective efficacy was maximal at 4 days and 13 days after irradiation. After 300 r and 800 r, efficacy was maximal at 4 days and 3 days after irradiation, respectively. (auth)

5004

IRRADIATED BLOOD-TYPING SERUM. Robert M. Jamison (Veterans Administration Hospital, Denver). J. Am. Med. Assoc. 172, 334(1960) Jan. 23.

Exposure of blood typing serums to a radiation dose of 250-Kvp, up to a total dose of 10,000 r in air, resulted in no significant alteration in specificity of reaction in blood typing. They remained suitable for clinical blood typing. (auth)

5005

LIVER LIPID RESPONSE TO INTRAVENOUS RARE EARTHS IN RATS. Fred Snyder, Edgar A. Cress, and Granvil C. Kyker (Oak Ridge Inst. of Nuclear Studies, Tenn.). J. Lipid Research 1, 125-31(1959) Oct.

Intravenous injection of rare earths with low atomic numbers produces fatty infiltration in the liver of rats. This infiltration is maximal 48 hours later and is characterized by an increase in neutral fat esters. Total cholesterol and phospholipids of the liver in cerium-treated rats were similar to those of control livers. Cerium was found to be effective in producing extremely high levels of liver fat in female rats of several strains tested. Male rats treated in the same way did not exhibit the consistent response or the high liver-lipid levels that were seen in the females. After the castration of male rats, their response

resembled that of females. Testosterone caused a significant reduction in the fatty infiltration induced by cerium in both intact and ovariectomized females. Hypophysectomy prevented fatty livers in both females and males, whereas adrenalectomy did so only in males. Choline and methionine had no protective effect against cerium. Tracer experiments involving cerium-144 demonstrated that most of the radioactivity appeared in the acid-soluble fraction of the liver and that the lipid fraction contained essentially no tracer. (auth)

5006

SEPARATION BY GAMMA-IRRADIATION OF TWO ELEMENTS AT THE V^{by} LOCUS IN TRIFOLIUM REPENS. D. Roy Davies and E. T. Wall (Wantage Radiation Lab., Berks, Eng.). Nature 184, Suppl. 25, 1957-8(1959) Dec. 19.

Many mutant phenotypes were found after gamma irradiation of somatic tissues of Trifolium repens. Practical applications of the new leaf-marks in the certification of clover seed as to strain are discussed. (C.H.)

5007

RADIOSENSITIVITY OF RABBIT LENS AND DEPENDENCE ON SPECIFIC GENES. U. Ehling and A. Mex (Universität, Berlin). Naturwissenschaften 46, 633-4(1959). (In German)

Experiments are described in which the eyes of 30 rabbits of different color types were x irradiated at 60 kv, 4ma and at a 4-cm distance with a 2-cm^2 field. The results show the dependence of the radiobiological reaction on a specific gene. (T.R.H.)

5008

DIAGNOSTIC USES OF RADIOISOTOPES. George C. Cotzias (Brookhaven National Lab., Upton, N. Y.). N. Y. State J. Med. 59, 3376-80(1959) Sept. 15.

Principles underlying diagnostic applications of radioisotopes are reviewed. Diagnostic procedures are divided into two classes, on the basis of whether an isotope was produced in situ in a given tissue for diagnostic purposes or whether it was conventionally manufactured and then introduced into the body. Topics discussed in detail include activation analysis, use of tracers in diagnosis, isotope dilution, flow rate techniques, tumor diagnosis, and isotopic diagnosis of metabolic disturbances. 26 references. (C.H.)

5009

ON THE SOIL CHEMISTRY OF CESIUM 137. R. K. Schulz, Roy Overstreet, and I. Barshad (Univ. of California, Berkeley). Soil Sci. 89, 16-27(1960) Jan.

The nonexchangeable fixation of macro amounts of cesium in five soils appeared to be different in character from the corresponding fixation of potassium and ammonium. It was also concluded that the fixation of cesium-137 in soils in carrier-free amounts is an essentially different process from those predominant in the fixation of macro amounts of cesium, potassium, and ammonium. Experimental procedures are described and results are discussed. (C.H.)

Biochemistry, Nutrition, and Toxicology

5010 AECU-4597

[Michigan State Univ., East Lansing].

ABSORPTION OF RADIONUCLIDES APPLIED TO ABOVE GROUND PLANT PARTS. Terminal Report. S. H. Wittwer, H. G. Tukey, and M. J. Bukovac. [1959]. 20p. Contract AT(11-1)-159. OTS.

A summary is presented of results of studies on the absorption of radionuclides by plants following application to above-ground parts. Several techniques for measuring foliar absorption by means of radioisotopes were developed. It was shown that absorption also occurs through above-ground parts other than leaves, including the bark of branches and twigs of trees, fruits, and flowers. Large quantities of nutrients were found to be lost from leaves and other above-ground parts by leaching from rainfall. Fission products, such as strontium-89, strontium-90, and ruthenium-103, were found to be readily absorbed by above-ground parts, but it was determined that no transport takes place from the absorbing site. Factors affecting absorption of foliar-applied nutrients were extensively studied. A list is included of 94 publications by staff members on the absorption and loss of nutrients by above ground plant parts. (C.H.)

5011 UR-561

Rochester, N. Y. Univ. Atomic Energy Project.

STUDIES ON THE TOXICITY OF THORIUM NITRATE. W. L. Downs, J. K. Scott, E. A. Maynard, and H. C. Hodge. Dec. 8, 1959. 35p. Contract W-7401-eng-49. OTS.

The acute toxicity of thorium nitrate (tetrahydrate) was determined following intraperitoneal injection of an aqueous solution of this salt into mature, female, albino rats. The toxicity of this compound was relatively low. The LD_{50} (at 48 hrs) was calculated to be 1220 mg/kg. Weanling rats appeared to be more resistant; limited data indicated that the LD_{50} for these rats was greater than 2000 mg/kg but less than 2500 mg/kg. Groups of 10 to 20 mature and weanling albino rats were fed diets containing 0, 0.05, 1.0, 3.0, 5.0, 8.0, and 10% thorium nitrate for a 4-month period. Dietary levels of 3% or greater resulted in moderate to severe growth depression. A dietary level of 1% produced a slight depression of growth in male rats only; no effect on growth was observed in the rats fed the 0.05% dietary level. Hematological findings were negative, except for rats fed the diet containing 10% thorium nitrate. At this level a lowered red cell count was noted. This decrease in the red cell count is probably not related to the ingestion of thorium but more likely to the reduced food intake which was observed in the rats fed this diet. Histopathological findings were negative at all dietary levels. A daily dose of 1.0 gm of thorium nitrate/kg was given orally to a 10 kg male dog for a 46-day period. The dog exhibited a slight decrease (15%) in body weight during the period of ingestion. Histopathological study of tissues, taken following sacrifice, showed no changes which could be attributed to the daily intake of the thorium salt. A second dog was fed 10 gm thorium nitrate/kg for two days. Food refusal was noted and the dose was reduced to 5 gm/kg. This dosage was fed for two days when death occurred. (auth)

5012 AEC-tr-3938

DATA ON THE DISTRIBUTION OF Pm^{147}. Yu. I. Moskalev. Translated by A. L. Monks (Oak Ridge National Lab.) from Med. Radiol. 4, No. 6, 73-5(1959). 5p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 16707.

5013

DETERMINATION OF CARBON-14 AND TRITIUM IN BLOOD AND OTHER WHOLE TISSUES. LIQUID SCINTILLATION COUNTING OF TISSUES. R. J. Herberg (Lilly Research Labs., Indianapolis). Anal. Chem. 32, 42-6(1960) Jan.

Liquid scintillation counting of carbon-14 and tritium in blood, heart, kidney, liver, spleen, lung, and muscle tissue was investigated. The dissolution of tissues into two different solvent systems and their counting are discussed.

The effect of dilution of such solvent and color quenched solutions is shown. Some counting efficiencies obtained for carbon-14, tritium, and sulfur-35 in different tissues and their variation are presented along with a general procedure for counting tissue samples. The liquid scintillation counting of whole tissues, although not possessing the efficiency of combustion techniques, is particularly useful for the assay of large numbers of samples. (auth)

5014

BIOLOGICAL ACTION OF POTASSIUM-40 IN NATURALLY OCCURRING POTASH SALTS. E. Welte and Kl. Mechsner (Landwirtschaftliche Forschungsanstalt Büntehof, Hanover). Nature 184, Suppl. 25, 1958-9(1959) Dec. 19.

No measurable effect on growth of Torula utilis was observed following the addition of various concentrations of potassium-40 to the growth media. Results are compared with the effects of additions of sodium, potash, sodium chloride, and enriched potassium-40. (C.H.)

Fallout and Radiation Ecology

5015 ARF-3127-10

Illinois Inst. of Tech., Armour Research Foundation.

PRELIMINARY STUDIES OF SCAVENGING SYSTEMS RELATED TO RADIOACTIVE FALLOUT. Letter Report No. 10 [for] October 1 to December 1, 1959. John Stockham and John Rosinski. Dec. 18, 1959. 8p. Contract AT(11-1)-626. OTS.

Progress is reported in the development of scavenging systems for the collection of fall-out. Data are included from tests of two cyclone separators for the collection of air samples. Results are included from laboratory studies on the scavenging of aerosol particles by evaporating and condensing water droplets. (C.H.)

5016 FFIF-IR-F-379

Norway. Forsvarets Forskningsinstitutt, Oslo.

SOME OBSERVATIONS ON CHANGES IN AIR ACTIVITY NEAR GROUND LEVEL. S. H. Small. May 1959. 16p.

Although the rate of stratospheric fall-out probably has some average mean value, the fall-out process may be rather sporadic. Frequent measurements of air activity at ground stations could be helpful in studying the fall-out process in detail. Probable causes of variations in air activity are summarized, and automatic equipment for collecting samples of airborne dust is described. Results are given from measurements made at Kjeller during March and April 1959. The diurnal variation of air activity may indicate the rate of dry deposition of radioactive materials. (auth)

5017 FFIF-IR-F-384

Norway. Forsvarets Forskningsinstitutt, Oslo.

CESIUM 137 IN MILK. A. Lillegraven. July 1959. 9p.

Samples of milk are collected weekly from three places in Southern Norway and measured gammaspectrographically for Cs^{137}. The results, covering 22 weeks, show large geographical variations of Cs^{137} concentrations, the averages for three locations being, respectively, approx. 49, 120, and 226 $\mu\mu c/l$. (auth)

5018 FFIF-IR-F-0391

Norway. Forsvarets Forskningsinstitutt, Oslo

WET AND DRY DEPOSITION OF FALLOUT MATERIALS AT KJELLER. S. H. Small. Oct. 1959. 16p.

Daily measurements of fall-out air activity and deposited activity at Kjeller from 1 Sept. 1956 to 30 Sept. 1959 are given as monthly means for days with and without obvious precipitation. It seems that significant concentrations of fall-out particles reach the earth about 3 months after high-yield test explosions. Dry deposition may reduce the amounts of fall-out materials available for capture by precipitation. (auth)

5019 HASL-73

New York Operations Office. Health and Safety Lab., AEC.

FURTHER INVESTIGATIONS OF NATURAL ENVIRONMENTAL RADIATION. Leonard R. Solon, Wayne M. Lowder, Arthur Shambon, and Hanson Blatz. Nov. 3, 1959. 34p. OTS.

Determination of the cosmic-ray ionization intensity as a function of altitude has permitted the separation of new and previously reported background radiation levels into cosmic and terrestrial components. Remeasurements in many locations furnished estimates of dosimetric increases in terrestrial levels due to fall-out. Radiation measurements in residential dwellings in the New York metropolitan area are described. (auth)

5020 ITR-1119

Chemical and Radiological Labs., Army Chemical Center, Md.

FALLOUT STUDIES. Edwin H. Bouton, Luther M. Hardin, and Michael J. Schumchyk. May 1955. Decl. Sept. 19, 1959. 144p. Project 2.5.1 [of] OPERATION TEAPOT. OTS.

The purpose of the project was to obtain the data required to close the 1 r/hr at H + 1 hr dose rate contour lines and in so doing obtain information concerning the role of the base surge as a primary carrier of activity, radiation intensities in areas contaminated by fall-out, base surge, and in the crater lip region, time of arrival of activity at locations within 2 to 5 miles of ground zero, depth of burial of activity in the crater and on the lip, and air-to-ground correlation factors developed during aerial survey of the contaminated areas. This information then will be applied to the problem of verifying and extending existing scaling relationships for the determination of contamination patterns resulting from the underground detonation of nuclear weapons at different scaled depths. Ground and aerial radiation intensity measurements made by this project and others have been used to arrive at contour lines which close the 100 mr/hr at H + 1 hr isodose line and nearly close the 10 mr/hr at H + 1 hr contour. These contours show the area inside the 3000 r/hr at H + 1 hr contour to be roughly 2 times that predicted by existing scaling methods and the area within the 100 r/hr contour to be less than one third that predicted. An analysis of time of arrival data, photography, and all other available data indicates that the base surge carried the fall-out and its associated activity in the upwind and crosswind direction. About 90% of the activity on the crater lip was contained in the first 12 inches of depth. Time of arrival data were obtained at seven locations from 300 to 4500 yd from ground zero. The fall-out appeared to have traveled downwind at a rate of approximately 2 mph. Gamma intensity measurements made in the fall-out area showed that the dose rate from H + 2 hr to D + 4 days followed $T^{-1.2}$ decay. Data were obtained which will furnish information concerning the effect of scaled depth upon such properties as specific activity, activity particle size distribution, and total activity associated with fall-out. (auth)

5021 NP-8133

California. Univ., Berkeley. Inst. of Engineering Research.

PREDICTION, MONITORING AND ESTIMATION OF RADIOLOGICAL FALLOUT PATTERNS FOR CIVIL DE-

FENSE. A. Broido, R. R. Read, and R. W. Shephard. Aug. 1, 1959. 37p. Contract CD-SR-58-40.

This report describes, without technical details, the theoretical and computational bases of a probabilistic approach to prediction, monitoring, and estimation of radiological fall-out patterns. The approach can lead to the design of a monitoring system for the quantitative assessment of the completed fall-out distribution in which the patterns can be obtained to a specified accuracy with fewer monitoring locations than would be required for the purely empirical approach of graphic interpolation between observations. Only limited countermeasures against the hazards of radiological fall-out are possible on the basis of preattack predictions of fall-out patterns. However, the prolonged time schedule of onset of radiological effects may permit the introduction of meaningful action based upon postattack prediction—utilizing monitoring information from regions of early fall-out arrival to progressively improve the accuracy of prediction for regions of subsequent contamination. For this purpose, the probabilistic approach, utilizing a suitable model of the sources and mechanics of the intrinsic variabilities involved in deposition of fall-out, may lead to a practicable procedure. (auth)

5022 NP-8134

California. Univ., Berkeley. Inst. of Engineering Research.

A PROBABILISTIC BASIC FOR DESCRIBING THE RADIATION INTENSITIES OF FALLOUT. Robert R. Read and Ronald W. Shephard. Apr. 7, 1959. 55p. Contract CD-SR-58-40.

The application of statistical regression techniques to the problem of finding minimum variance linear estimators for positions of deposited fall-out particles given some meteorological information in the form of hodographs is outlined. It is indicated how these methods can be integrated with stabilized cloud models to obtain probabilistic fall-out models. The mathematical problems that arise when converting particle position estimators into radiation intensity estimators are exhibited for purposes of presenting the meanings of certain simplifying assumptions that are often made. Methods for calculating variances and covariances of radiation intensity residuals from the estimated values are presented. A formula for the joint probability density function of distances of deposited cloud slice centers from a particular point is derived, under the assumption that wind velocities form a Gaussian process. (auth)

5023 NP-8135

California. Univ., Berkeley. Inst. of Engineering Research.

TECHNIQUE FOR DESIGNING AND EMPLOYING A RADIOLOGICAL MONITORING SYSTEM FOR THE EVENT OF ATTACK. Interim Report. Robert R. Read. Apr. 10, 1959. 29p. Contract CD-SR-58-40.

A method for estimating fall-out isointensity contours on the basis of ground monitored radiological measurements and of a probabilistic model describing the behavior of such measurements is presented. This method can be used either for interpolation among several measurements or for the downwind prediction of additional hazardous areas where fall-out has not yet occurred. Using such an estimation procedure as a basis, the report describes a technique for determining what radiological measurements are necessary for a ground monitoring system, including the specification of which regions are to be monitored. (auth)

5024 NP-8136

California. Univ., Berkeley. Inst. of Engineering Research.

AN EXTRAPOLATION FROM FISSION PRODUCT SPECTRA TO FALLOUT SPECTRA. I. R. Jones. June 1, 1959. 15p. Contract CD-SR-58-40.

Using unclassified sources of information, an estimate is made of the neutron-induced gamma-ray activity accompanying fission. This is combined with available information on the gamma-ray activity of fission products to provide an estimate of the gamma-ray spectra of fall-out. (auth)

5025 NP-8191

Brussels. Centre d'Etude de l'Energie Nucleaire.

LA RETOMBEE RADIOACTIVE MESUREE AU C.E.N. AU COURANT DES ANNEES 1955-56 ET 57. (Radioactive Fallout Measured at C.E.N. During the Years 1955-56 and 1957). R. Boulenger. Jan. 27, 1958. 17p.

Fall-out measurements at the Centre d'Etude Nucleaire, Mol, Belgium, are reported and discussed. The data given include measurements of β activity of Sr^{90} and Sr^{89} in rain and in air for '55, '56, and '57. These values are correlated with various US, UK, and USSR nuclear tests and with rainfall. (T.R.H.)

5026 USNRDL-TR-366

Naval Radiological Defense Lab., San Francisco.

SPECIFICATIONS AND COSTS OF A STANDARDIZED SERIES OF FALLOUT SHELTERS. W. E. Strope, L. G. Porteous, and A. L. Greig. Oct. 6, 1959. 136p.

Basic performance specifications are developed to govern the design of personnel shelters to provide protection against radioactive fall-out. Consideration is also given to protection against blast, heat, and fires. Design specifications and cost estimates are prepared for a shelter based on a 25 ft by 48 ft ammunition storage magazine. Provision is made for 14-day occupancy by 100 people. The cost differentials of various choices of performance characteristics are estimated. The design is in sufficient detail to permit construction. Shelters of this type may have wide application in residential areas, industrial plants, and military installations. (auth)

5027 WT-1154

Naval Radiological Defense Lab., San Francisco.

DISTRIBUTION AND INTENSITY OF FALLOUT FROM THE UNDERGROUND SHOT. R. L. Stetson, T. H. Shirasawa, M. M. Sandomire, S. Baum, H. K. Chan, and L. B. Werner. Mar. 14, 1958. Decl. Sept. 19, 1959. 94p. Project 2.5.2 [of] OPERATION TEAPOT. OTS.

One phase of the over-all fall-out studies on the underground detonation during Operation TEAPOT, was to make total fall-out collections defining the magnitude and extent of the entire fall-out event in terms of quantity of material dispersed and deposited. Such information was required to supplement and extend data from previous surface and subsurface tests, both nuclear and high explosive, and to test and improve prediction methods developed from these data. Material and radioactive fall-out was documented by sampling the fall-out at an array of ground stations deployed to include the major portion of the residual field. Limited time-sampling of fall-out was performed, and duplicate total fall-out-collection stations were employed to check validity of the total-fall-out-collection techniques. Results have been converted to a unit-area basis and recorded according to position in the master-station locator plan established for all Military Effects Group fall-out studies. It is estimated that 9.16×10^6 pounds of soil, which comprises

3.6% of the total crater material, and 2.9×10^{22} fissions, which comprises 17% of the fission yield for the device, were deposited in the sampled area. Adequate data were obtained to show the variation in mass and radioactivity with distance in all directions from surface zero. Graphs of different types depicting these variations are presented. Field gamma-flux values obtained by the project are included for comparison. Estimates of variance were determined separately for the mass and gamma activity data. A common value of ±30% obtained for the standard deviations was attributed to the sampling procedure, which was identical for the two sets of data. (auth)

5028
RADIOACTIVE FALL-OUT MEASUREMENTS AT HORNSUNDFIORDEN IN SPITSBERGEN, DURING THE POLISH 1957-58 I.G.Y. EXPEDITION. Zbigniew Jaworowski (Inst. of Nuclear Research, Warsaw). Nukleonika 4, 195-8(1959). (In Polish)

From September 1957 until March 1958 measurements of rain, snow, and dust radioactivity were made, using the pot sampling method. Dates of atomic explosions were estimated by means of the Way-Wigner formula with a discrepancy of one to four days. The average activity of 0.2 mc per sq kilometer was found as well as the decay rates and energies that could be attributed to strontium-89. (auth)

5029
THE UPTAKE OF ^{90}Sr BY RYEGRASS. A. Morgan (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 11, 8-13(1959) Nov.

It is shown that 20% of the 'fall-out' Sr^{90} deposited in rain can appear in the aerial parts of ryegrass growing during the period of deposition. It is considered that almost all this activity is taken up directly by the leaves, stems and surface roots and not by the roots in the soil. This suggests that rate of fall-out is the controlling factor in determining the Sr^{90} content of grass. The 'fall-out' Sr^{90} in the three soils used in the experiment was not less available to the ryegrass than freshly added Sr^{85}, suggesting that the availability of Sr^{90} does not decrease to any appreciable extent with time. (auth)

Radiation Effects on Living Tissues

5030 AECU-4568
Pittsburgh. Univ. School of Medicine.
ATTEMPTED MODIFICATION OF SUSCEPTIBILITY OF TUMORS TO X-IRRADIATION. Final Report [for] August 1, 1957 to August 31, 1959. Lyle V. Beck. Dec. 31, 1959. 22p. Contract AT(30-1)-1738. OTS.

Attempts were unsuccessful to secure a high degree of synchronization of cell division of the Krebs mouse ascites carcinoma by combined use of aminopterin and citrovorum factor, and by use of colchicine and N-acetyl colchinol. A new method was developed for securing smears of ascites tumor cells. Results are also reported from a study of the relation between mitotic stage of tumor cells and their susceptibility to damage by x irradiation. (C.H.)

5031 TID-8204
Division of Raw Materials, AEC and Division of Biology and Medicine, AEC.
RELATIONSHIPS BETWEEN THE GEOLOGIC ENVIRONMENT AND MORTALITY FROM CONGENITAL MALFORMATION. Jack Kratchman and Douglas Grahn. Aug. 1959. 23p. OTS.

Deaths from congenital malformations as a fraction of total deaths for the period 1952 to 1956 were tabulated from vital statistics records of the United States. The data were tabulated by county and state and the results grouped by geologic province. The data from this preliminary study suggest that mortality incidence from malformation may be higher in those geologic provinces of the United States that contain major uranium ore deposits, uraniferous waters, or helium concentrations. It is inferred that these provinces have a higher than average level of environmental radiation. Although the data do not permit conclusive statements regarding the etiology of congenital malformation in reference to the geologic environment, they are sufficiently provocative to warrant further investigation. (auth)

5032 USNRDL-TR-382
Naval Radiological Defense Lab., San Francisco.
ANEMIA AND LEUKOPENIA IN SUBLETHALLY X-IRRADIATED F_1 HYBRID MICE AFTER INJECTION OF PARENTAL STRAIN BLOOD. R. M. Garver and L. J. Cole. Nov. 16, 1959. 17p.

The delayed lethal syndrome elicited by the injection of A-strain (i.e., parental) blood into sublethally x-irradiated (LxA) F_1 hybrid mice is accompanied by a sequence of events with respect to the peripheral blood picture. The leukocyte level falls to essentially zero, makes an abortive attempt at recovery at about 7 days and falls again, remaining at very low levels until the death of the animal. All control groups exhibited a continuous rise toward normal, beginning at about seven days after irradiation. Erythrocytes fell in a roughly linear fashion until death. Control groups began recovery at 14 days, and were within the normal range by 24 days. Reticulocytes dropped to essentially zero, and increased at about seven days, remaining within the normal range thereafter until death. Control groups showed marked reticulocytosis at about 16 days, coinciding with the beginning of the return toward normal erythrocyte levels. The significance of these results with respect to the etiology of homologous disease in bone-marrow-treated, lethally-irradiated mice is discussed. It is suggested that the differences observed in homologous disease initiated by bone marrow, lymphoid tissue or blood, may depend upon the lymphoid/myeloid and erythroid ratio of the injected material. Possible causes of the observed anemia are discussed, and it is suggested that further study of this aspect of homologous disease is indicated. (auth)

5033 JPRS-L-1092-N
THE INFLUENCE OF PENETRATING RADIATION ON THE STATE OF THE HIGHER NERVOUS ACTIVITY IN ANIMALS. V. B. Baskakov. Translated from Med. Radiol. 4, No. 8, 10-13(1959). 8p. OTS.

A chamber is described for use in studying response to conditioned and unconditioned stimuli in rats, mice, and guinea pigs. The chamber was employed in studies of the effect of penetrating radiation on the functional condition of the central nervous system of gravid and suckling rats. A dose of 250 r x radiation resulted in a number of changes in the conditioned reflex of the animals. These changes occurred much earlier in gravid and suckling animals and lasted longer in the gravid animals. (C.H.)

5034 JPRS-L-1093-N
CONCERNING CERTAIN MECHANISMS OF THE INFLUENCE OF LOW DOSES OF CHRONIC TOTAL-BODY X-IRRADIATION ON THE HIGHER NERVOUS ACTIVITY AND CERTAIN VEGETATIVE FUNCTIONS OF WHITE RATS. L. G. Samoilova (Samoylova). Translated from Med. Radiol. 4, No. 8, 13-17(1959). 9p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20825.

5035 JPRS-L-1094-N

CHAIN REACTIONS IN LIVER LIPIDS AFTER RADIATION INJURY. A. I. Zhuravlev and E. (Ye.) E. Ganassi. Translated from Med. Radiol. 4, No. 8, 32-7(1959). 10p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20830.

5036 JPRS-L-1096-N

FURTHER STUDY OF THE PROBLEM OF THE INFLUENCE OF IONIZING RADIATION ON THE ANTIGENIC PROPERTIES OF PROTEINS. V. A. Artamonova. Translated from Med. Radiol. 4, No. 8, 42-8(1959). 10p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20832.

5037 JPRS-L-1097-N

RADIATION INJURIES OF THE OVARIES. M. N. Pobedinskii (Pobedinskiy). Translated from Med. Radiol. 4, No. 8, 72-8(1959). 18p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20837.

5038 JPRS-L-1099-N

PROBLEMS OF RADIATION GENETICS AT THE CONFERENCE ON "HEREDITY AND PROBLEMS IN HUMAN PATHOLOGY". V. N. Benevolenskii (Benevolenskiy). Translated from Med. Radiol. 4, No. 8, 92-3(1959). 4p. OTS.

On March 23 and 24, 1959, a conference on Heredity and Problems of Human Pathology was held at the Institute of Experimental Biology of the Academy of Medical Sciences, Moscow, U.S.S.R. One of the sessions of the conference was devoted to the problem of radiation genetics, chiefly of an experimental nature. Brief summaries of these reports are included. (C.H.)

5039 JPRS-L-1149-N

PROPHYLACTIC USE OF CERTAIN SULFUR CONTAINING SUBSTANCES IN EXPERIMENTAL RADIATION AFFECTIONS. E. (Ye.) A. Mukhin. Translated from Med. Radiol. 4, No. 9, 29-33(1959). 9p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 1417.

5040

EFFECT OF WHOLE-BODY X-IRRADIATION ON THE ADRENAL MEDULLA AND THE HORMONES ADRENALINE AND NORADRENALINE. McC. Goodall and Merritt Long (Memorial Research Center and Hospital, Knoxville, Tenn.). Am. J. Physiol. 197, 1265-70(1959) Dec.

The purpose of these experiments was to determine the effect of x irradiation on the adrenaline and noradrenaline content of the adrenal gland and on the biosynthesis of these hormones. Rats, rabbits, and cats were irradiated. Adrenal glands were removed at various times post irradiation and assayed for adrenaline and noradrenaline. Further, irradiated adrenal slices were incubated with labeled tyrosine and labeled methionine and the effect of irradiation upon the biosynthesis of adrenaline and noradrenaline determined. The results of these experiments show that x irradiation (1770 r) does not decrease the biosynthesis of adrenaline and noradrenaline. However, whole-body irradiation does cause the adrenaline and noradrenaline content of the adrenal gland to decline; the adrenal gland content ultimately returns to normal. In view of these findings, it would seem that x irradiation represents another form of stress in which the physiological demand for adrenaline and noradrenaline is so great that the adrenal gland is partially or completely depleted of its adrenaline-noradrenaline storage. (auth)

5041

EFFECT OF X-IRRADIATION ON HEPATIC CARBOHYDRATE ENZYMES IN CONTROL AND HYPOPHYSECTOMIZED RATS. George Weber and Antonio Cantero (Montreal Cancer Inst., Research Labs., Notre Dame Hospital and Univ. of Montreal). Am. J. Physiol. 197, 1284-90 (1959) Dec.

The sequence of metabolic events was investigated in rats for 8 days after exposure to 600 r total-body x irradiation. The preirradiation studies showed that in hypophysectomized animals 18 hours of fasting reduced the activities of enzymes involved in glucose-6-phosphate utilization indicating that the hypophysis is involved in the physiological maintenance of these enzymatic activities. In control animals after irradiation fasting blood sugar and liver glycogen increased reaching a peak at 3 days and returning to normal range at 8 days postirradiation. Hepatic phosphohexoseisomerase and phosphoglucomutase activities indicated the presence of an increased glycogenesis and gluconeogenesis. Liver 6-phosphogluconate dehydrogenase activity increased to almost double the preirradiation value and stayed at this level during the whole postirradiation period. Glucose-6-phosphatase activity was not affected by irradiation. In hypophysectomized animals after irradiation blood sugar, liver glycogen and most enzymatic activities remained essentially in the preirradiation level, indicating that hypophysectomy abolished the characteristic carbohydrate metabolic response to radiation. The deficient metabolic reaction of hypophysectomized animals was correlated with the increased mortality rate in this group. (auth)

5042

MORPHOLOGICAL AND GENETIC EFFECTS OF IONIZING RADIATION ON THE WHEAT VARIETIES, "CAPPELLI," AND "BRESCIA." Francesco D'Amato and Enrico Moschini (Università, Cagliari, Italy and Università, Pisa, Italy). Caryologia 12, 317-37(1959). (In Italian)

The effects, in the first (R_1) and second (R_2) generations, of the irradiation of dormant seeds of durum (Cappelli) and bread (Brescia) wheat with different doses of x rays and thermal neutrons were studied. Data on the following R_1 effects have been reported: survival, tillering, plant height at maturity, and spike fertility. In the R_2 of Cappelli a good frequency of chlorophyll mutations (maximum rate: 11.66% on a spike-progeny basis) has been observed; in Brescia, on the contrary, the mutation rate of the chlorophyll system did not exceed 1% in any of the treatments. The frequency of morphological mutations in both bulk progenies and spike progenies is reported. In Cappelli the mutation rate per spike progeny does not exceed 2.62%, while mutation frequencies as high as 26.53 to 33.15% are found in Brescia. (auth)

5043

ELECTROENCEPHALOGRAPHIC CHANGES AFTER X-IRRADIATION OF THE BRAIN. W. Rube (Freien Univ., Berlin). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 91, 789-98(1959) Dec. (In German)

Electroencephalographic changes following X-ray irradiation of the brain are described. The practical significance

of the experimental findings in guinea-pigs are considered in relation to the EEG findings following radio-gold implantation into the hypophysics in man. The lack of dependence of bio-electric phenomena on dose once a threshold of 2,000 r is exceeded and the pathogenesis of somatic irradiation damage with reference to functional changes are discussed. A regular and reproducible functional change following irradiation of the brain was found. This provides a model for further radio-biological investigations. (auth)

5044

BIOLOGICAL AND BIOCHEMICAL EFFECTS OF IONIZING RADIATION. 8. THE REACTION MECHANISM OF RADIOLYSIS OF VITAMINS IN AQUEOUS SOLUTION. H. J. Maurer (Universität des Saarlandes, Homburg, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 91, 799-803(1959) Dec.

Investigations of the mechanism of the radiolysis of vitamins in aqueous solution showed that: either oxidation or reduction processes occur or that these can take place simultaneously or consecutively. H_2O_2 does not play a significant role since it can only act through its break-down products. The results are discussed with reference to observations. (auth)

5045

THE "ALL-OR-NONE" NATURE OF X-RAY INDUCED BACKMUTATION AT THE MELEZITOSE LOCUS IN SACCHAROMYCES. Carl C. Lindgren and David Pittman (Southern Illinois Univ., Carbondale). Genetica 30, 169-89 (1959).

Results are reported from a study of the nature of x-ray-induced backmutation at the melezitose locus in Saccharomyces. The findings support the view that backmutation to wild type is a single event and involves an all or none reaction. The possible nature of the radiation-induced events leading to sequential degradation of the gene and its abrupt restoration to wild type is discussed. (C.H.)

5046

BIOLOGICAL DAMAGE IN MATURE AND IMMATURE GERM CELLS OF DROSOPHILA VIRILIS WITH IONIZING RADIATIONS. Mary L. Alexander, Janet Bergendahl, and Madeleine Brittain (Univ. of Texas, Austin and M. D. Anderson Hospital and Tumor Inst., Houston, Tex.). Genetics 44, 979-99(1959) Nov.

Data are reported on translocation and dominant lethal damage produced in the spermatogenic cycle of Drosophila virilis by exposure to 200 kv x rays, 22 Mv x rays from a betatron source, and gamma rays from a cobalt-60 source. Among postmeiotic cells both dominant and lethal translocations were produced with a higher frequency in spermatids than in sperm. A comparison was made of the relative biological efficiency of the three types of radiation. (C.H.)

5047

RADIATION-INDUCED AND GENETICALLY CONTRIVED DOMINANT LETHALITY IN HABROBRACON AND DROSOPHILA. R. C. von Borstel and M. L. Rekemeyer (Oak Ridge National Lab., Tenn.). Genetics 44, 1053-74(1959) Nov.

Three kinds of dominant embryo lethals, distinguished phenotypically, were induced by radiation in Habrobracon. A similar situation was found to exist in Drosophila but only two kinds were distinguished by the criteria employed. It is concluded that although chromosome imbalance phenomena can mimic some of the dominant lethality induced by radiation, the majority of radiation-induced dominant lethals in Habrobracon and Drosophila are not mimicked by genetically contrived loss of chromosomes or loss of chromosome parts. The experimental procedure is described and findings are discussed. (C.H.)

5048

SOME NOTES ON THE WHOLESOMENESS OF IRRADIATED POTATOES FED TO PIGS. T. Horne and J. R. Hickman (Wantage Radiation Lab., Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 6, 255-7(1959) Oct. (In English)

Pigs were fed control and irradiated potatoes from 11 weeks of age till ready for slaughter for bacon production. The irradiation dose was 10,000 rads. The weight gains and food conversions for the pigs are given for the period of the experiment. No gross differences were observed. Blood samples taken at intervals showed no detectable differences in haemoglobin, urea, non-protein nitrogen, P.C.V., or plasma cholesterol. The bacon quality of the pigs was assessed in terms of the commercial value and no differences were observed. (auth)

5049

DORMANCY RESULTING FROM GAMMA-IRRADIATION OF LETTUCE SEED. Alan H. Haber and Helen J. Luippold (Oak Ridge National Lab., Tenn.). Intern. J. Radiation Biol. 4, 317-27(1959) Oct.

Lettuce seeds given 300 to 1000 kr of gamma-rays show inhibition of germination when subsequently put into water. That this failure to germinate was caused by seed dormancy was suggested by the fact that such irradiated seeds did germinate if treated with any of the following germination-stimulating agents: gibberellic acid, kinetin, thiourea, pricking, or light. Germination was accompanied by cellular expansions and cell divisions, irrespective of radiation and chemical treatments. The first four agents mentioned were fully effective under conditions where continuous white light was not. The chemical treatments, which reversed the gamma-radiation effects on germination, gave no reversal of any of the following gamma-radiation effects: inhibition of respiratory rates, production of chromosomal aberrations, and reduction in seedling height. Consequently, the chemical treatments that enabled gamma-irradiated seeds to germinate had radioprotective activity specific for the germination process. These results further support the conclusion that gamma-radiation prevented germination by inducing (or maintaining) dormancy and preclude alternative explanations in terms of killing, mitotic inhibition, or general growth inhibition. (auth)

5050

THE EFFECTS OF IONIZING RADIATION ON RAT THORACIC-DUCT LYMPHOCYTES IN VITRO. E. H. Cooper and E. L. Alpen (Univ. of Oxford and United Oxford Hospitals). Intern. J. Radiation Biol. 4, 344-59(1959) Oct.

The effects of x radiation on nucleic acid and protein metabolism of rat thoracic-duct lymphocytes in vitro have been investigated. Only 3 to 4 per cent of the total thoracic-duct lymphocytes in vitro are synthesizing DNA at any given time. The 2000 rads x ray caused a 20 to 25 per cent depression of the rate of DNA synthesis but did not effect RNA or protein metabolism. The metabolism of formate by the lymphocytes in vitro has been studied, and evidence is presented to show that formate can be utilized for purine, amino acid, and DNA-synthesis. The inhibition of DNA-synthesis by the lymphocytes in vitro was shown to be identical whether the cells were irradiated in vitro or in vivo. (auth)

5051

THE EFFECT OF IONIZING RADIATION ON THE ENZYME DESOXYRIBONUCLEASE IN THE DRY STATE. Dwight E.

Wilson (Rensselaer Polytechnic Inst., Troy, N. Y.). Intern. J. Radiation Biol. 4, 360-5(1959) Oct.

The radiation sensitivity of the enzyme DNase in the dry state may be altered in the presence of added materials. In the presence of sodium chloride or sodium phosphate the radiation sensitivity of DNase is increased. This radiation sensitivity was found to vary, depending on the pH of the environment before freezing and drying. The addition of desoxyribonucleic acid was found to increase the radiation sensitivity above pH 6.5 and to decrease the sensitivity below pH 6.5. The radiation-sensitivity changes which occur in the presence of DNA include a specific decrease, dependent on the intact DNA-molecule, and a non-specific effect, in the presence of the degraded substrate or of intact RNA. The DNA-specific sensitivity change is probably a result of energy transfer from the enzyme to the substrate via the enzyme-substrate attachment site. (auth)

5052

A COMPARISON BETWEEN THE EFFECTS IN MICE OF INJECTED ORGANIC PEROXIDES AND OF WHOLE-BODY X-IRRADIATION. J. St. L. Philpot and D. B. Roodyn (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Radiation Biol. 4, 372-82(1959) Oct.

The toxic effects of whole-body x irradiation and of intraperitoneally injected linoleic acid peroxide, disuccinoyl peroxide, dibenzoyl peroxide, 1 hydroxycyclohexyl hydroperoxide, tetralin hydroperoxide, and tert.-butyl hydroperoxide have been studied in RQ mice. There is no resemblance between the times of death after radiation and after peroxides. The latter act very rapidly, and most deaths occur in the first three days after treatment. Disuccinoyl peroxide and dibenzoyl peroxide differ from radiation in their effect on the growth-curves of animals surviving sub-lethal doses. Additive experiments, in which peroxides and radiation are given together, do not generally cause any marked augmentation of toxic effects by the two agents. A.E.T. protects successfully against radiation, but does not protect against any of the peroxides tested. Conversely, doses of ascorbic acid which protect against disuccinoyl peroxide do not protect against radiation. It is concluded that in those aspects studied there is little resemblance between radiation and injected peroxide. (auth)

5053

RADIATION AND HORMONE EFFECTS UPON LYMPHOCYTE RELEASE FROM ISOLATED PERFUSED DOG SPLEENS. Marvin Goldman and L. W. Tuttle (Univ. of Rochester, N. Y.). Intern. J. Radiation Biol. 4, 403-13 (1959) Oct.

Studies on lymphocyte release from isolated perfused dog spleens following administration of adrenal extracts and irradiation indicate that the rate of cell release was proportional to the perfusion flow-rate and independent of hormone dosage. The hormone-induced cell release into the perfusate was eliminated by 100 r of x irradiation to the spleen during perfusion, causing lymphocytolysis in situ; but 200 r of whole-body Co^{60} irradiation two to four days prior to splenectomy did not prevent lymphocyte release under the influence of adrenal cortex extract. Treatment with A.C.E. caused white-pulp hypoplasia. Marked pyknosis of white pulp and perfusate lymphocytes was observed within two hours following 100 r or x-irradiation. A synergism of effect upon the spleen was noted when irradiation and steroid hormones were administered within short intervals of each other. The lymphocytes released into the perfusate appeared to originate in the bands of medium-sized lymphocytes in the splenic white pulp. Perfusion did not impair reticulo-endothelial efficiency. (auth)

5054

VARIABILITY IN THE OXYGEN EFFECT OBSERVED WITH MICRO-ORGANISMS. PART I. HAPLOID YEAST: SINGLE AND BUDDING CELLS. Tikvah Alper (Hammersmith Hospital, London). Intern. J. Radiation Biol. 4, 414-19(1959) Oct.

When freshly harvested haploid yeast is exposed to x rays or 8 Mev electrons, the oxygen-enhancement ratio is twice as high for the sensitive single cells as it is for the more resistant budding cells. It may be inferred that the principal targets for lethal damage are different in the two types of cell. (auth)

5055

ARE IRRADIATED FOODS HARMFUL? Herman F. Kraybill. Nucleonics 18, No. 1, 112; 14-15(1960) Jan.

There is no evidence that there is any toxicity in irradiated foods for either man or animals. The Office of the Surgeon General stated that no ill effects on growth, reproduction, and longevity could be traced to irradiated food. Circulated stories suggest that irradiated foods fed to animals gave rise to (a) bleeding disorders, (b) blindness in rats, (c) heart defect or auricular rupture in mice, and (d) sterility or infertility in dogs. All four of these radiation effects are discussed herein. (B.O.G.)

Radiation Sickness

5056 JPRS-L-1095-N

PRIMARY TOXICITY IN ACUTE RADIATION SICKNESS. Ye. D. Buglov, S. I. Dovgalev, and V. G. Karavaev (Karavayev). Translated from Med. Radiol. 4, No. 8, 37-41(1959). 10p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20831.

5057 JPRS-L-1150-N

CERTAIN CLINICAL AND THERAPEUTIC PROBLEMS OF ACUTE RADIATION SICKNESS IN MONKEYS. A. A. Bagdasarov, M. O. Raushenbach (Raushenbakh), G. V. Sukyasyan, G. M. Abdullaev (Abdullayev), M. N. Novikova, N. Ya. Lagutina, N. L. Samoilina (Samoylina), and G. A. Chernov. Translated from Med. Radiol. 4, No. 9, 17-24 (1959). 15p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 1416.

5058

THE EFFECT OF BREATHING ATMOSPHERES OF DIFFERENT OXYGEN CONCENTRATIONS ON THE RADIOSENSITIVITY OF THE MOUSE KNEE JOINT AS MEASURED BY THE DEPRESSION OF UPTAKE OF PHOSPHORUS 32. C. W. Wilson (Westminster Hospital, London). Brit. J. Radiol. 32, 815-17(1959) Dec. (In English)

The radiosensitivity of the mouse knee joint, as measured by depression of uptake of P^{32}, is shown to depend upon the oxygen content of the atmosphere breathed during irradiation. No increase of radiosensitivity was detected when the atmosphere breathed consisted of pure oxygen but reduction of the oxygen in the atmosphere to only 10% reduced the radiosensitivity to approximately 50%. Presumably the mouse knee joint is normally very well oxygenated. (auth)

5059

MODIFICATION OF ^{59}Fe UPTAKE IN THE CIRCULATING BLOOD OF LETHALLY IRRADIATED RATS PROTECTED

WITH CYANIDE. A. Bose (Chittaranjan National Cancer Research Centre, Calcutta). Intern. J. Radiation Biol. 4, 383-6(1959) Oct.

The incorporation of Fe^{59} in the blood has been used to measure the protection by sodium cyanide of the hemopoietic system of rats irradiated with 800 r whole-body x rays. The results indicate definite protection, although this is insufficient to protect the life of animals receiving such heavy doses of radiation. (auth)

CHEMISTRY

General and Miscellaneous

5060 AECU-4544

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

STUDY OF EQUILIBRIUM BETWEEN METALS AND THEIR POLYVALENT CHLORIDES IN LiCl–KCl EUTECTIC MELT. Ling Yang, Robert G. Hudson, and Chien-yeh Chien. [1959]. 27p. OTS.

Dilute solutions of uranium, thorium, zirconium, and columbium chlorides in LiCl–KCl eutectic melts were made by anodic dissolution of these metals. After equilibrium was reached between the solution and the metal, the electrode potential was measured relative to a AgCl reference electrode. The nature of the metal ions in the equilibrated melt was determined either from the slope of the isothermal plots of potential versus the logarithm of concentration, or by using Faraday's law. It was found that in the temperature range of 760 to 830°K, U^{3+}, Th^{4+}, Zr^{4+}, and Nb^{3+} are the predominant species existing in the uranium chloride (0.26 to 2.08% U), thorium chloride (0.19 to 1.47% Th), zirconium chloride (0.07 to 0.86% Zr) and niobium chloride (0.13 to 0.43% Nb) melts, respectively. For niobium chloride melts of higher concentrations than that shown above, other species of niobium ions, probably Nb^{4+}, coexists with Nb^{3+} in appreciable amounts. The results are explained on the basis of the magnitude of the free energy of formation of the chlorides of these metal ions of different valence states and the tendency for these metal ions to form complex ions with the chloride ions in the melt. (auth)

5061 AECU-4552

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

POLAROGRAPHIC THEORY, INSTRUMENTATION, AND METHODOLOGY. David N. Hume. 1959. 33p. Contract AT(30-1)-905. OTS.

This bibliography on polarographic theory, instrumentation, and methodology surveys the literature appearing between mid-1957 and mid-to-late 1959. 189 references. (W.L.H.)

5062 AECU-4570

[Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy].

KINETICS OF REACTIONS BETWEEN TWO LIQUID PHASES. L. H. Fister and T. B. King. 1955. 24p. Contract AT(30-1)-1985. OTS.

The analogy between metallurgical slag–metal systems in which simple displacement reactions take place and geometrically similar low-temperature systems is considered. The latter is used to study in a general way the effects of the system size and the shape and convection conditions on the rates of such reactions. The system consists of isobutanol and water with caproic acid as the transferring solute. The liquids are contained in cylindrical vessels and forced convection is accomplished by mechanical stirring. Data are given on the characteristic dimension, the exponent of the Reynolds number, and various flow relationships. (J.R.D.)

5063 AECU-4590

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

ORGANIC COOLANTS AND MODERATORS FOR NUCLEAR REACTORS. A Literature Search. E. U. Kauer. Dec. 1959. 10p. OTS.

A literature search of NSA, Vols. 12 and 13, for information on organic coolants and moderators is presented. Properties of biphenyl, diphenyl methane, Dowtherm A, α-phenyl naphthalene, and terphenyl (o, m, p, and technical grade) are considered. (W.D.M.)

5064 AERE-CE/R-1998

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

TRANSPORT AND CHEMICAL CONTROL IN THE DISSOLUTION OF METALS IN MERCURY. J. A. R. Bennett and J. B. Lewis. June 1957. 48p.

The dissolution rates of tin, lead, and zinc in mercury and of benzoic acid in water and aqueous sucrose were investigated under conditions in which solid cylindrical specimens are held stationary and concentric cells containing the solvent are rotated about them at predetermined speeds. The results indicate that the dissolution of tin and lead in mercury is transport controlled. The mass transfer coefficient data for these and the benzoic acid systems were correlated by the expression $\frac{KL}{\nu} = 0.018 \left(\frac{Lu}{\nu}\right)^{0.8} \left(\frac{\nu}{D}\right)^{-0.5}$ The zinc data do not fit the correlation due to the influence of a mean chemical rate with an activation energy of the order of 10 kcal/mole. Qualitative results obtained with single and multi-crystalline specimens of zinc indicate that different crystal planes of the zinc lattice dissolve at different rates. Data were also obtained for the dissolution of benzoic acid in water and aqueous sucrose by use of the expression $\frac{KL}{\nu} = 0.135 \left(\frac{Lu}{\nu}\right)^{0.8} \left(\frac{\nu}{D}\right)^{-0.4}$. (auth)

5065 CEA-888

France. Commissariat à l'Énergie Atomique, Paris.

ADSORPTION DE COMPOSÉS ORGANIQUES VOLATILS PAR LE POLYTÉTRAFLUOR ÉTHYLÈNE. (Adsorption of Volatile Organic Compounds by Polytetrafluoroethylene). J.-M. Martinet. 1958. 68p.

The sorption of organic vapors by microporous polytetrafluoroethylene has been studied gravimetrically using a McBain-Baker type sorption balance. The amount of sorption, the peculiarities observed on the isotherm curves, the small influence of temperature, and smallness of hysteresis suggests that mainly physical adsorption occurs when the temperature is around 25°C. The values of the surface areas obtained from the adsorption isotherms using organic vapors differ greatly from those derived from N_2 adsorption measurements. This discrepancy cannot be completely attributed to differences in the structure and chemical function of the adsorbate molecules, or to the porous structure of the adsorbant. On the contrary, the surface area values obtained by sorbing high volatile freons conform with those measured by nitrogen adsorption, which seems to imply a connection between the area of sorbed monolayers and volatility of the adsorbate. (auth)

5066 CF-59-12-4
Oak Ridge National Lab., Tenn.
CURVES FOR COMPUTATION OF KINETIC ISOTOPE EFFECTS. Gus A. Ropp. Dec. 8, 1959. 11p. OTS.

Curves for estimation of the ratio of the specific rate constant for unlabeled molecules (k^*/k) are presented. These may be estimated from the measured value of labeled substrate converted and either the measured molar radioactivity of accumulated product, residual labeled substrate, or a small increment of product. The curves are applicable to calculation of kinetic isotope effects due to isotopic substitution of elements other than hydrogen. (J.R.D.)

5067 IDO-14490
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
EXCHANGE STUDIES OF THE URANIUM–TRIBUTYL PHOSPHATE REACTION. Bernard Keisch. Nov. 10, 1959. 23p. Contract AT(10-1)-205. OTS.

The kinetics and mechanism of the interfacial reaction of uranium with tributyl phosphate have been investigated by means of a heterogeneous exchange technique in a vessel of special design. At 25°C the rate law was determined to be $\text{Rate} = k(UO_2^{++})_{aq}(NO_3^-)_{aq}^{1.2}(TBP)_{org}^{1.8}$. The dominant reaction path varies with temperature at 6 to 45°C. Mechanisms were proposed to fit the rate laws determined. (auth)

5068 IGR-160(RD/R)
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
BERYLLIUM DATA MANUAL. E. L. Francis, comp. June 1, 1959. 37p. BIS.

A compilation of the best available unclassified data on the chemical, mechanical, and physical properties of beryllium is presented. 47 references. (J.R.D.)

5069 IS-16
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN ENGINEERING FOR JANUARY–JUNE 1959. Nov. 1959. 27p. Contract W-7405-eng-82. OTS.

Chemical Engineering. The method by which a solvent (tributyl phosphate) extracts a solute ($Nd(NO_3)_3$) from an aqueous solution is being studied. A correlation for predicting entrainment from bubble cap trays is being developed. Drop size of the dispersed phase in Scheibel packing was measured as a function of flow rates and inlet drop diameter for the methyl isobutyl ketone–water system. The design, construction, and operation of a forced convection loop for circulating liquid Pb–Bi mixtures is reported. The development of a liquid metal cooled condenser for the vacuum distillation of metals is described. Methods are reported for the preparation of low oxygen content YF_3. Nuclear Engineering. The design of the subcritical nuclear assembly using an aqueous slurry of UO_2 is being modified to improve the flow characteristics and to reduce costs. A U–Cr eutectic was circulated in a Y loop at 1000°C for 250 hr. A Th–Mg eutectic was circulated in a Nb system for 650 hr before automatic shutdown occurred due to a failure in the winding of the power supply to the electromagnetic pump. Ceramic Engineering. Pure UO_2 can be sintered to greater than 95% theoretical density by firing to 1700°C in a hydrogen atmosphere. The refractory characteristics of the $MgO–CaF_2$ system are being investigated. Protective ceramic coatings were developed for Y metal. (For preceding period see ISC-1118.)

5070 K-1438
Oak Ridge Gaseous Diffusion Plant, Tenn.
ORGANIC FLUORINE COMPOUNDS PREPARED BY THE ELECTROCHEMICAL METHOD: LITERATURE SURVEY, 1950–JULY 1959. Sarah Ann Shahan. Jan. 15, 1960. 20p. Contract W-7405-eng-26. OTS.

References to the literature concerning electrochemical fluorination of organic compounds for the period 1950–July 1959 were compiled. A total of 119 items is included. (auth)

5071 NAA-SR-3638
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CONTROL OF OXYGEN CONCENTRATION IN A LARGE SODIUM SYSTEM. R. B. Hinze. Dec. 1, 1959. 45p. Contract AT-11-1-GEN-8. OTS.

Data on the performances of two types of cold traps in the 50,000-lb radioactive sodium system at the SRE are tabulated. The rates were determined when trap inlet oxygen concentrations were at 8 to 10 parts per million. Oxygen concentration was readily controlled to 8 ppm using a cold trap. Extraction of oxygen from sodium by zirconium at 1200°F (hot trapping) reduces the concentration below the limit of detection, i.e., oxide solubility saturation temperature below 225°F. The theoretical limit for the equilibrium oxygen concentration was calculated to be less than 7×10^{-4} ppm. The observed extraction rate of 0.009 lb oxygen/hr was one-half of the rate predicted from material behavior studies. (auth)

5072 NP-8153
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
SPECTRAL ANALYSIS OF THE POWDER SIFTING METHOD. PART I. THE TECHNIQUE. Report No. 102/VIII. J. Czakow. Aug. 1959. 22p.

A simple powder sifting technique in which a tripartite sifter electrode is employed was developed for spectrographic analyses in a continuous or interrupted arc. Sensitivity of the method was on average by one order of magnitude higher than in the method of evaporation from cavities and precision is very high. The samples were excited from slightly modified conventional generators. The factors affecting sifting discussed in the paper include electrode temperature, size and distribution of holes in the sifter electrode, type of electrical discharges, excitation atmosphere, and sample characteristics. (auth)

5073 NP-8184
Northwestern Univ., Evanston, Ill.
CATALYTICALLY ACTIVE SOLIDS—CHEMISORPTION AND MAGNETIZATION. Robert E. Dietz. Nov. 1, 1959. 156p. Project NR-051-143. Contract Nonr-1228(08).

The saturation magnetization of nickel particles in the diameter range 20 to 60 A has been measured. These particles are supported in silica, as in typical nickel-silica hydrogenation catalysts. For the larger nickel particles the saturation magnetization is within 1 per cent of that of massive nickel. Measurements have also been made of the saturation magnetization of nickel particles after chemisorption of hydrogen. The effect of hydrogen is to decrease the magnetization. The most accurate results show that the magnetization is decreased by 0.6 to 0.8 Bohr magneton per atom of hydrogen adsorbed. These results have been interpreted in part, in terms of nickel-hydrogen bond type, and have been related to low field permeameter studies at room temperature and above. The data obtained under these conditions have been interpreted in terms of variables such as surface coverage, temperature, field intensity, and distribution of particle sizes. (auth)

5074 NP-8186
Saskatchewan. Univ., Saskatoon.
OPTICAL INVESTIGATIONS OF INITIATION AND DETO-

NATION: I. REACTION TIME AND RELATED TOPICS. II. INITIATION AND LOW ORDER DETONATIONS. III. SUPPLEMENTARY RESULTS. [Period covered] March 1945–August 1946. G. Herzberg and G. R. Walker. 72p. Project XR-84.

The duration of the detonation luminosity of various explosives was studied. A propane or water surround was used to eliminate the shock wave luminosity in the surrounding medium. Only upper limits for the luminosity times are given. For RDX-BWX 91-9 pellets this limit is 0.03 μsec. For all other cases investigated it is 0.1 μsec. It appears that these upper limits for the luminosity time represent also upper limits for the reaction time. The corresponding upper limits for the length of the luminosity zone are between 0.3 and 0.9 mm. These also appear to be the upper limits for the length of the reaction zone. The shape of the detonation front for RDX-BWX and TNT pellets and for cast amatol 55/45 was studied on end-on photographs of long cylindrical charges. For RDX-BWX 91-9 pellets of 16 mm diameter no deviation from the geometrical wave front is found. For TNT pellets of the same diameter a slight backward bend amounting to 0.4 ± 0.2 mm near the edge is found. For amatol of 31 mm diameter a considerable deviation amounting to 3.7 mm is found. Any zone of incomplete detonation near the edge of the charges is less than 0.3 mm thick. In a spherical detonation wave in RDX-BWX the detonation velocity has its maximum value for all but the first two millimeters from the center. The same conclusion can be drawn from photographs of cast NENO charges in which two nearly plane detonation waves met at a 60° angle. (auth)

5075 NP-8206

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

SYNTHESIS OF SEMI-INORGANIC FLUORINE POLYMERS. Quarterly Progress Report No. 5 [for] September 1, 1959 through November 30, 1959. Henry C. Brown. 26p. Contract AF33(616)5616.

Perfluoroalkyl imidines, $R_FC(:NH)N = C(NH_2)R_F$, previously postulated as intermediates in the deammoniation reaction of perfluoroalkyl amidines, have been synthesized and identified. These compounds form stable, water-insoluble chelates with Cu(II) and Zn ions. Perfluoroglutarodinitrile in excess reacts with perfluorobutyramidine at comparatively low temperatures to form an apparently polymeric product, probably through the intermediate formation of the imidine linkage. Attempts have been made to cotrimerize perfluoroalkylnitriles with cyanogen bromide and with cyanogen. No trimer containing perfluoroalkyl groups was obtained under the conditions used. (For preceding period see NP-7941.) (auth)

5076 NP-8208

Stanford Research Inst., Menlo Park, Calif.

HIGH TEMPERATURE SYNTHESIS OF NEW, THERMALLY STABLE CHEMICAL COMPOUNDS. Report No. 14. Quarterly Progress Report No. IV [for] July 1 to September 30, 1959. L. C. Bratt, D. L. Chamberlain, and F. A. Ferguson. Oct. 30, 1959. 19p. SRI Project No. SU-2590. Contract AF33(616)-5940. OTS.

Studies of syntheses of difluoroacetylene and thiophosphonitrilic and organometallic compounds are described. Difluoroacetylene was tentatively identified as a component of the gaseous products resulting from the pyrolysis of disodium tetrafluorosuccinate; various spectral analyses of this compound are reported. An improved experimental apparatus for synthesis of SPN compounds from P_4S_3 and N_2 in the electric arc was designed and constructed. In one run at reduced pressure, a yellow product with a composition approximating the empirical formula $P_{13}S_6N_{15}$ was obtained. The product was translucent and noncrystalline. Equipment for flash pyrolysis of organic compounds by means of a plasma jet was designed and constructed. Synthesis of organometallics with this equipment was negative and the equipment is being modified. (J.R.D.)

5077 NRL-5398

Naval Research Lab., Washington, D. C.

EFFECT OF HYDROGEN PRESSURE ON THE HYDROGEN OVERVOLTAGE ON BRIGHT RHODIUM. S. Schuldiner. Aug. 31, 1959. 15p. Project NR-475-000.

The effect of hydrogen pressure on the hydrogen overvoltage on bright, active rhodium was determined. The data indicated that the overvoltage mechanism was controlled by the $2\,H_{ads} = H_2$ step. Kinetic parameters for the mechanism were quantitatively determined including the surface coverage with adsorbed atomic hydrogen. A Langmuir adsorption isotherm resulted from the relationship between surface coverage with atomic hydrogen at equilibrium and the partial pressure of molecular hydrogen above the solution. (auth)

5078 NRL-5401

Naval Research Lab., Washington, D. C.

SURFACE ACTIVITY OF FLUORINATED ORGANIC COMPOUNDS AT ORGANIC-LIQUID/AIR INTERFACES. PART III. EQUATION OF STATE OF ADSORBED MONOLAYERS AND WORK OF ADSORPTION OF A FLUOROCARBON GROUP. N. L. Jarvis and W. A. Zisman. Sept. 1, 1959. 9p. Project NR-472-00.

Previous investigations have demonstrated that a wide variety of partially fluorinated carboxylic esters are capable of adsorbing as unimolecular films at the interfaces between various organic liquids and air, and also that these films are usually in a gaseous or otherwise expanded state. In the present study it is shown that isotherms of film pressure (F) vs. area (A) per adsorbed molecule of solute, at large values of A, obey the simple equation of state $(F + F_0)(A - A_0) = kT$. However, as the film pressures increase, the deviation from this equation increases. The two-dimensional analog of the van der Waals equation $(F + a/A^2)(A - A_0) = kT$, which includes a more definitive correction factor for the intermolecular attraction between neighboring molecules in the film, was in good agreement with the experimental data even at very low areas per molecule. The constants a and A_0 of the van der Waals equation were calculated for the F vs. A isotherms of solute in various solvents, and the relation of these constants to the organophobic-organophilic balance in the solute molecules and to the association of solute and solvent molecules is discussed. In addition, the work of adsorption $\Delta\lambda$ of $-CF_2-$ groups at each organic-liquid/air interface was calculated. The plot of $\Delta\lambda$ vs. solvent surface tension was a straight line, which extrapolated fairly well to the value for $-CF_2-$ groups adsorbed at the water/air interface, as determined from surface tension vs. concentration isotherms given in the literature for fluorinated solutes in water. (auth)

5079 NRL-5411

Naval Research Lab., Washington, D. C.

FLUOROALKOXYSILANES. C. M. Murphy, J. G. O'Rear, H. Ravner, and P. Sniegoski. Sept. 24, 1959. 15p. Projects NO 804-188/81002/01371 and NA 581-029.

Eight fluoroalkyl esters of silicic acid and one of phosphoric acid were prepared from the fluoroalcohols $F(CF_2)_nCH_2OH$, $H(CF_2CF_2)_nCH_2OH$, $H(CF_2CF_2)_nCHOH(CH_3)$, and $H(CF_2CF_2)_nCOH(CH_3)_2$. These orthoesters were studied

as potential high-temperature lubricants and hydraulic fluids. Most of the compounds have pour points below −65°F. Increasing the fluorine content improves flammability resistance but raises the viscosity-temperature coefficient. Orthoesters derived from primary fluoroalcohols are resistant to pyrolysis and oxidation but sensitive to hydrolysis. Stabilization against hydrolysis is achieved by introducing one or two tert-butoxy groups but at the expense of thermal and oxidation stability. Both secondary and tertiary fluoroalkoxy groups are inferior to tert-butoxy groups for stabilizing orthoesters against hydrolysis. The best compromise structures fail one or more of the requirements for a satisfactory high-temperature lubricant or hydraulic fluid. (auth)

5080 ORO-80

Goodrich (B.F.) Co. Research Center, Brecksville, Ohio. PLASTIC AND ELASTOMERIC MATERIALS AS SHIELDING COMPONENTS FOR NUCLEAR REACTORS. J. W. Born. July 2, 1952. Decl. Oct. 2, 1959. 23p. BFG Projects 17RB and 16RC. Contract AT(40-1)-1309. OTS.

Properties of elastomeric and plastic materials for use in reactor shielding were investigated. The materials selected for examination are described, and experimental results are tabulated. One hundred sixteen compounds were prepared and studied. The best material found for attenuating neutrons is a butyl gum rubber stock while the best for combination neutron-gamma shield material is a natural rubber compound containing TiH_2. (J.R.D.)

5081 UCRL-8961

California. Univ., Berkeley. Lawrence Radiation Lab. BIO-ORGANIC CHEMISTRY QUARTERLY REPORT, JUNE, JULY, AUGUST 1959. Sept. 24, 1959. 56p. Contract W-7405-eng-48. OTS.

Progress in photoinduced electron spin resonance signals in photosynthetic material is reported. The action spectra on a sample of spinach chloroplasts is described, and an expression for the dynamic behavior of such material at 7400 A is given. In an investigation of crystalline choline chloride decomposition, an NMR study of acetaldehyde–water mixtures was conducted. Data are tabulated on the chemical shift of nonequivalent protons in aldehydes and their hydrated forms. Work was started on the general problem of the fate of recoiling tritons in the presence of methyl halides; apparatus was assembled and preliminary work was done to improve mechanical techniques. A proposal for a direct viewing radioactive paper chromatogram for use with plant extracts containing C^{14} is presented. Experiments are being conducted to use hydrogen-adapted algae and tritium gas as a system for the study of the path of hydrogen in photosynthesis. In the presence of a urea (CMU) compound the adapted algae shows a marked resistance to de-adaptation under conditions of high light intensity. Experiments in formation of 2-carboxy-4-ketopentitol from $C^{14}O_2$ in Chlorella pyrenoidosa indicate that the γ-keto acid is not formed by a direct carboxylation reaction. Data on the appearances of radioactivity in compounds of the diphosphate area as a function of time and CO_2 pressure are tabulated. The fixation of $C^{14}O_2$ by fragments prepared from sonically ruptured chloroplasts is being investigated. Data on the chlorophyll-to-nitrogen weight ratios of the resulting chloroplast fractions are given along with data on $C^{14}O_2$ fixation by various fractions. Data on the inhibition of CO_2 in Chlorella pyrenoidosa by a urea (CMU) are given in terms of radioactivity in the various compounds from these cells. Studies of the effects of D_2O on Drosophila were continued, and data on sterility in the flies indicate that the female is more sensitive to the effects of D_2O than the male. Data from experiments on the effects of Orinase on radiation sickness suggest that this compound does not counter the biological effects of radiation in mice. A preliminary investigation of a carbonaceous chondrite was conducted and data on its elemental composition, and on the results of various spectral analyses are presented. (For preceding period see UCRL-8848.) (J.R.D.)

5082 WADC-TR-59-512

Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
PERARYLATED SILANES. IDENTIFICATION BY X-RAY DIFFRACTION POWER PATTERNS. Frank L. Chan and Leonard Spialter. Sept. 1959. 35p. Project Nos. 7364 and 7023. OTS.

X-ray-powder-diffraction data are presented for twenty arylsilanes in various forms of graphic presentation for ease in identification, characterization, and analysis. These include the actual pictorial diffraction patterns, extended listings of d-spacings with relative intensities, and a Hanawalt-type index identifying the catalogued compounds by means of all combinations of the three most intense lines. Purity of silanes is stressed to minimize confusion and errors arising from impurities and polymorphic forms. To ensure accuracy in measuring distances and intensities of lines on the diffraction plates, recordings of their microphotometer traces were taken and precisely read. A similarity of d-spacings was observed for the most intense line, but not for those of lesser intensity, in the powder pattern of each of these compounds. This suggests a possible correlation between this pattern component and a basic element of molecular structure in a class of compounds. (auth)

5083 CEA-tr-A-611

DISPOSITIF DE REMPLISSAGE POUR MICROBURETTE SIMPLE. (Filling Apparatus for Simple Microburette). S. Mayer and O. G. Koch. Translated into French from Mikrochim. Acta, No. 4, 576-7(1958). 4p.

A microburette with a filling bulb is described which has a 1 to 10 ml burette with stop-cock on one side of the rubber bulb and a stop-cock on the other. (T.R.H.)

5084 CEA-tr-R-193

MÉCANISME ACIDO-BASIQUE D'ADSORPTION SUR SILICAGEL. (Acid-Base Mechanism of Adsorption on Silica Gel). A. V. Kiselev (Kisselev). Translated into French from Doklady Akad. Nauk S.S.S.R. 106, 1046-9 (1956). 10p.

The physical nature of adsorption on silica gel is discussed, and a chemical acid–base mechanism is proposed. (T.R.H.)

5085 CEA-tr-R-357

BALANCE ENREGISTREUSE FONCTIONNANT SOUS VIDE POUR L'ÉTUDE DE LA CINÉTIQUE ET DE L'ÉQUILIBRE DANS LES SYSTÈMES HÉTÉROGÈNES. (Recording Balance Operating in Vacuum for Study of Kinetics and Equilibria in Heterogeneous Systems). G. G. Mottik (Mouttik). Translated into French by B. de Trezvinsky from Zhur. Fiz. Khim. 31, 263-5(1957). 11p.

A balance developed for the study of adsorption is described. It consists of a brass beam with a steel axis suspended by an 18 μ W wire, the whole arranged in a T-form glass tube. The sample is suspended from the beam into the bottom extension of the T. The balance is controlled by an electromagnet. The automatic recorder is operated by a signal generated by a beam of light transmitted to a photoelectric cell by a mirror system.

The device is useful in studying thermal decomposition, hydration, distillation, and other heterogeneous systems where a particular atmosphere or vacuum is required. (T.R.H.)

5086 CEA-tr-R-719
CONDENSATION DE L'AMONIAC À PARTIR DU MÉLANGE AZOTE–HYDROGENE. (Condensation of Ammonia from a Nitrogen–Hydrogen Mixture). F. P. Zaostrovskii (Zaotrovsky) and P. K. Kovtun. Translated into French by B. Vinogradoff from Khim. Prom., No. 5, 292-5(1958). 15p.

The method of calculating "by steps" was used to study the condensation of NH_3 from N_2–H_2 mixtures. In this method the temperature and partial pressure differences are considered as arithmetic averages of their values at the beginning and end of a selected interval. The results of the calculations are presented as curves. The curves show that formation of a vapor in the gas mixture in the condensing apparatus causes HN_3 synthesis. (T.R.H.)

5087 CEA-tr-R-721
ETUDE DU SYSTÈME NITRATE D'URANYLE EAU–ETHER DIBUTYLIQUE, ISOTHERME DE SOLUBILITÉ À 25°. (Study of the Uranyl Nitrate–Water–Dibutyl Ether System. Solubility Isotherm at 25°C). V. M. Vdovenko and I. G. Suglobova (Souglobov). Translated into French from Zhur. Neorg. Khim. 3, 1403-9(1958). 22p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13881.

5088 CEA-tr-R-722
INFLUENCE DE LA CONCENTRATION DES IONS HYDROGÈNE SUR LA CINÉTRIQUE D'EXTRACTION DES COLLOIDES EN SOLUTION À L'AIDE DE MOUSSE. (Effects of Hydrogen Ion Concentration on the Kinetics of Extraction of Colloids in Solution Using Foam). R. V. Shvelkina (Shueikina) and S. G. Mokrushin (Mokrouchine). Translated into French from Zhur. Priklad. Khim. 31, 943-5(1958). 10p.

A study was made of the effects of pH on extraction of the dispersed phase, made up of different hydrosols, using gelatine foam. These sols were used: Sb_2S_3, Au, $Fe(OH)_3$, and $Ti(OH)_4$. The pH effect is very great, the maximum extraction rate being obtained at the isoelectric point of gelatine. The rate for Sb_2S_3 and Au increased at low pH. For pH near 10 the rate increased only for Au, but decreased for $Fe(OH)_3$ and $Ti(OH)_4$. (T.R.H.)

5089 CEA-tr-R-724
APPAREIL POUR LA MESURE SANS CONTACT DE LA CONDUCTIBILITÉ ÉLECTRIQUE DES ÉLECTROLYTES ET AUTRES SUBSTANCES. (Apparatus for Measurement Without Contact of the Electric Conductivity of Electrolytes and Other Substances). L. M. Suvorov. Translated into French from Zavodskaya Lab. 24, 889-90(1958). 5p.

An apparatus and circuit are given for measuring electric conductivity by induced currents in the sample solution. The apparatus is useful in analytical chemistry, soil analysis, and corrosion studies. (T.R.H.)

5090 CEA-tr-R-728
INTERACTION DES OXYDES DE NÉODYME ET DE LANTHANE AVEC LE CHLORE GAZEUX. (Reaction of Oxides of Neodymium and Lanthanum with Gaseous Chlorine). I. S. Morozov and B. G. Korshunov. Translated into French from Zhur. Neorg. Khim. 1, 2606-12(1956). 16p.

The chlorination of Nd_2O_3 and La_2O_3 was studied at 200, 250, and 300°C. The equilibrium constants and free energy variations were determined for the reaction $2R_2O_3 + 6Cl_2 \rightleftharpoons 4RCl_3 + 3O_2$. (T.R.H.)

5091 CEA-tr-X-156
ETUDES DES CATALYSEURS DE CONTACT POUR LA DÉCOMPOSITION DU PÉTROLE. XV. SPECTRES D'ABSORPTION DANS L'INFRA-ROUGE DES CATALYSEURS DE CONTACT UTILISÉS DANS LA DÉCOMPOSITION DU PÉTROLE. (Study of Contact Catalyzers for the Decomposition of Petroleum. XV. Infrared Absorption Spectra of Contact Catalyzers used in Decomposition of Petroleum). K. Ikebe. Translated into French by Sen-Sik Minn from Kôgyô Kagaku Zasshi 61, 575-6 (1958). 11p.

Infrared absorption spectra of petroleum cracking catalysts were studied to determine if they are simple physical mixtures or chemically combined. Specifically, the spectra of SiO_2–Al_2O_3, SiO_2–MgO, and Al_2O_3–B_2O_3 were compared with spectra of SiO_2, Al_2O_3, MgO, and B_2O_3. It was found that cracking catalyzers present absorption bands differing from those of their constituents. The experimental results show that these catalyzers are solid acids formed by a combination of the oxides during precipitation or sintering. (T.R.H.)

5092 CEA-tr-X-159
CHAMBRE DE RÉACTION HD. PROPRIÉTÉS THERMODYNAMIQUES DE LA RÉACTION $H_2O + D_2 \rightleftharpoons 2HD$. (HD Reaction Vessel. Thermodynamic Properties of the Reaction $H_2O + D_2 \rightleftharpoons 2HD$). José Raul Carrasco. Translated into French by J. Dirian from Rev. mex. fis. 4, 35-51 (1955). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5895.

5093 CEA-tr-X-167
NOUVELLES SORTES D'HYDRATE D'ALUMINE. (New Type of Alumina Hydrate). Y. Shimizu, S. Miyashige, and K. Funaki. Translated into French by E. Hara from Kôgyô Kagaku Zasshi 61, 475-6(1959). 9p.

The conditions for precipitation of a new type of aluminum oxide hydrate $Al_2O_3 \cdot 3H_2O$ are given. The NH_3 is introduced rapidly into an $Al(NO_3)_3$ solution to form aluminagel. After many washings with distilled water, the mixture was filtered and aged in solution. A second filtration followed, then the product was dried and studied x-ray-diffraction spectrographically by an automatic apparatus. A pure product was not obtained. (T.R.H.)

5094 HW-61493
OXIDATION OF METALLIC URANIUM. J[ean] Loriers. Translated by C. Groot (Hanford Atomic Products Operation) From Compt. rend. 234, 91-3(1952). 5p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 6, as abstract No. 1435.

5095 NP-tr-324
SPECIFICATIONS FOR PETROLEUM PRODUCTS. (Tekhnicheskiye Normy Na Nefteprodukty). Translated from a publication of the State Scientific-Technical Publishing House of Petroleum and Mineral Fuel Industry, Moscow, 1957. 517p. OTS.

Specifications for all commercial petroleum products produced by the petroleum industry in accordance with USSR government standards are presented. Descriptions of sampling and test methods are included along with handling and identification procedures. (J.R.D.)

5096 NP-tr-326
THERMODYNAMIC RESEARCH BY THE METHOD OF EXPLOSION AND COMPUTATION OF COMBUSTION PROC-

ESSES. (Termodinamicheskiye Issledovaniya Metodom Vzryva i Raschety Protsessov Goreniya). A. M. Gurvich and Yu. Kh. Shavlov. Translation of a publication of Moscow Univ., 1955. 185p. OTS.

An outline of the methods for computing the characteristics of combustion processes on the basis of thermodynamic functions and equilibrium constants is presented. A review of statistical methods for thermodynamic quantities is included along with calculation methods for equilibrium constants. Methods for correcting the maximum explosion pressure for combustion product temperature gradient, and for computation of temperature distribution in the combustion product mixtures as a function of distance from explosion centers are also given. Calculation of combustion product thermal capacities from maximum explosion pressures is described and examples to illustrate computation procedures are included. (J.R.D.)

5097 SCL-T-290

ORIENTATION STATES IN HIGH POLYMERS. (Orientierungszustände in Hockpolymeren). W. Kast. Translated by Marcel I. Weinreich (Sandia Corp.) from Kolloid-z. 120, 40-52(1951). 26p. JCL.

The orientation states are characterized by quantitative and qualitative data. The result of those combined data is a great multiplicity of the orientation states which come about by the conditions of elongation. The rodlet orientation shows the highest quality, whereby the elongation and its affinitive distortion in space act only upon the crystallite axes, so that orientation of uniaxial nature ensues. The state of the lamellar orientation represents a quality which is one step lower. The lowest orientation state is the uniplanar. (J.R.D.)

5098

INORGANIC-ORGANIC CATION EXCHANGE ON MONTMORILLONITE. James L. McAtee, Jr. (National Lead Co., Houston, Tex.). Am. Mineralogist 44, 1230-6(1959) Nov.-Dec.

Replacement of the inorganic cations on montmorillonite by base exchange with organic compounds has been followed by step-wise additions of the organic compound to the clay. It has been shown that a primary amine has enough basic character to react with montmorillonite by the base exchange mechanism. Data are also given showing the replacement of sodium, calcium, and magnesium for montmorillonite and hectorite treated with a large quaternary ammonium salt. The sodium on montmorillonite is replaced stoichiometrically while calcium and magnesium require greater than the stoichiometric amount of organic for replacement. (auth)

5099

STUDY OF CADMIUM SULPHIDE CRYSTALS GROWN FROM THE VAPOUR PHASE IN A STREAM OF ARGON. J. Woods (General Electric Co., Ltd., Wembley, Eng.). Brit. J. Appl. Phys. 10, 529-33(1959) Dec.

Crystals of cadmium sulfide were grown by reacting a stream of argon containing cadmium vapor with a stream of hydrogen sulfide. The variations in crystal habit which occur are very similar to those reported for ice crystals by Hallett and Mason. Growth features were studied using a metallurgical microscope. Although growth occurs in layers, spirals were observed only on rare occasions. The evidence indicates that ordinary two-dimensional nucleation over a plateau is more common, and is affected by the impurities added. Nucleation also occurs at sites on the edge of a crystal face or at the apexes of re-entrant angles between growth steps from neighboring sources. Various types of cavity were observed in the volume of some crystals, and possible methods of formation are discussed. (auth)

5100

COMPARATIVE STUDY BY INFRARED SPECTROSCOPY OF THE BEHAVIOR IN SOLUTION OF SOME Y—H AND Y—D OSCILLATORS. Jean-Pierre Leicknam, Jean Lascombe, Nelson Fuson, and Marie-Louise Josien (Faculté des Sciences, Bordeaux). Bull. soc. chim. France No. 10, 1516-23(1959) Oct. (In French)

Within the framework of the Kirkwood-Bauer-Magat theory, the valence frequency variations of the HCl and OH oscillators of phenol and the NH of pyrrole are compared to those of the homologous deuterated vibration. Two methods for determining the isotopic ratio of the donor-acceptor association constants and the photon and deuteron are described. The results obtained for the pyrrole-hexamethyl-benzene and phenol-hexamethylbenzene complexes in carbon tetrachloride solution are given. (tr-auth)

5101

ADSORPTION EQUILIBRIA OF HYDROGEN, DEUTERIUM, AND THEIR MIXTURES. PART I. D. Basmadjian (Univ. of Toronto). Can. J. Chem. 38, 141-8(1960) Jan.

Adsorption isotherms of hydrogen and deuterium were measured at temperatures of 75 to 90°K and pressures up to 760 mm Hg on the following adsorbents: charcoal, silica gel, and Linde molecular sieves type 4A, 5A, and 13X. Deuterium was found to be adsorbed to a greater extent than hydrogen in all cases investigated, its isosteric heat of adsorption exceeding that of hydrogen by 50 to 300 cal/mole. Binary adsorption isotherms were determined on the same adsorbents in the range 10 to 90% D_2 at temperatures of 75 and 90°K and a total pressure π of 750 and 200 mm Hg. The analyses were performed by the thermal conductivity method using thermistor sensing elements in a static system at atmospheric pressure. The device proved of exceptional stability, requiring no recalibrations and yielding an analytical accuracy of better than 0.02% deuterium content. The binary separation factors α were found to be constant over the concentration range investigated, with values for α varying from about 1.25 on charcoal to 2.54 on type 4A molecular sieves at 75°K and 750 mm Hg. The results suggest that the variations in α are due mainly to differences in chemical composition of the adsorbents rather than pore size, surface area, or origin of the materials. (auth)

5102

ADSORPTION EQUILIBRIA OF HYDROGEN, DEUTERIUM, AND THEIR MIXTURES. PART II. D. Basmadjian (Univ. of Toronto). Can. J. Chem. 38, 149-56(1960) Jan.

An investigation was made of the fundamental factors which determine isotope separation factors on adsorbents, based on hydrogen and deuterium isotherms previously reported. Through the use of a semiempirical thermodynamic approach, the binary separation factors α were related to the single component isotherms ($p = f(v)$), and these in turn broken down into a number of terms involving the isosteric heat of adsorption q, temperature T, and surface coverage. Equations are presented which agree well with the experimental results. It is suggested that the horizontal zero-point vibrations of the adsorbed species in some cases constitute an important contributing factor in addition to the vertical vibrations previously thought to be solely responsible for differences in isotope behavior. (auth)

5103

POLAROGRAPHIC AND OSCILLOGRAPHIC STUDY OF LANTHANIDES. L. Treindl (Komenský-Universität, Bratislava). Collection Czechoslov. Chem. Communs. 24, 3389-3401(1959) Oct. (In German)

The depolarization action of lanthanide ions from the Ce group was studied by the classical polarographic method, pulse polarography, and oscillopolarography with applied current. It is pointed out that information by other workers concerning the three-electron diffusion-limit step and the two-step reduction in deformable solutions is erroneous. Lanthanide halohydrides ($LaHX_2$, LaH_2X, and LaH_3) were considered as the polarographic reduction products, and their proportions depend on the electrode potential. This interpretation is also supported by experiments with a prepared mixture of lanthanum hydride which also appears in solutions as non-deformable anions at the stationary Hg electrode near the reversible steps and also at an anodic step for positive potentials. (tr-auth)

5104

ON CONGRUENT SOLUBILITY OF THE III AND V GROUP ELEMENTS IN GERMANIUM. V. M. Glazov, D. A. Petrov, and S. N. Chizhevskaya. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 153-5(1959) July-Aug. (In Russian)

Investigations of AlSb, GaSb, and InSb solubility in Ge show maximum solubilities of 0.19, 0.48, 0.11, and 0.03 for aluminum, gallium, indium, and antimony, respectively. (R.V.J.)

5105

DETERMINATION OF PARTICLE SIZE BY β-BACK-SCATTERING. P. Connor, W. H. Hardwick, and B. J. Laundy (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Appl. Chem. (London) 9, 525-31(1959) Oct.

A cumulative method of particle size analysis is described wherein the mass deposited from a homogeneous suspension by gravitational or centrifugal force is determined by a β-back-scatter thickness measurement technique. The method is applicable to compounds having an effective atomic number greater than 16, and comparisons of results obtained by this and other methods for thoria, urania, zirconia, and lithopone powders are given. The scattering efficiency of various materials is given. (auth)

5106

DISLOCATIONS IN TWO TYPES OF CdS CRYSTALS. D. C. Reynolds (Aeronautical Research Lab., Wright Patterson AFB, Ohio) and S. J. Czyzak (Univ. of Detroit, Mich.). J. Appl. Phys. 31, 94-8(1960) Jan.

Dislocation densities in CdS crystals (types I and II) were investigated employing chemical etching techniques. There is very little difference in the dislocation densities in the two types of CdS crystals. The dislocation density in both types of growth varies over a range from $10^3/cm^2$ to $10^1/cm^2$. However, type I crystals have a greater tendency to twin and low angle boundaries are generally present in the twinned crystal. (auth)

5107

X-RAY DIFFRACTION STUDY OF BISMUTH POLYMER IN AQUEOUS PERCHLORATE SOLUTION. H. A. Levy, M. D. Danford, and P. A. Agron (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 31, 1458-61(1959) Dec.

X-ray-diffraction study of an aqueous solution of bismuth perchlorate has established the presence of a polymeric species containing six bismuth atoms in octahedral arrangement. The bismuth-bismuth distances are 3.70 and 5.23 A. (auth)

5108

NONEQUILIBRIUM KINETICS AND CHROMATOGRAPHY. J. Calvin Giddings (Univ. of Utah, Salt Lake City). J. Chem. Phys. 31, 1462-7(1959) Dec.

An effort is made to deal with the complex kinetic processes which determine the structure of component zones in chromatography. The problem is approached by assuming that the various steps are proceeding near equilibrium. In order to facilitate the analysis an approximation is made in which each derivative of a concentration is replaced by the derivative of the equilibrium concentration. The latter derivatives are evaluated in terms of the concentration profile. This yields a set of linear algebraic equations from which an equilibrium departure term, ϵ, can be found for each species. The diffusion of the zone is then obtained as a function of the various ϵ's. The simplicity introduced by this method allows one to obtain the zone diffusion term for complex kinetics in contrast to the rigorous theories where only the simplest kinetic schemes were treated. The results for a simple kinetic example are the same, however, as obtained in the limit of large times by the rigorous methods. The validity of the assumptions made is established independently of this comparison. Various applications of the method are discussed which extend beyond the range of chromatographic analysis. (auth)

5109

NEGATIVE ION MASS SPECTRA OF HYDROCARBONS AND ALCOHOLS. C. E. Melton and P. S. Rudolph (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 31, 1485-8 (1959) Dec.

The complete negative ion mass spectra and relative sensitivity for positive and negative ion formation in various organic compounds are herein reported for the first time. These compounds include methane, the C_2^- hydrocarbons, n-butane, and all of the alkyl alcohols through the butyls. A limited comparison of the observed ionic patterns with molecular structure and chemical properties manifests a correlation. Relative sensitivities for positive and negative ion formation in these compounds show that formation of positive ions is about four orders of magnitude more probable than formation of negative ions under the conditions used in this study. (auth)

5110

LATTICE VIBRATIONS IN ALKALI HALIDE CRYSTALS. I. LITHIUM AND SODIUM HALIDES. Arnold M. Karo (Univ. of California, Livermore). J. Chem. Phys. 31, 1489-99(1959) Dec.

Vibrational frequency distributions for the lithium and sodium halides were evaluated on the basis of the Born lattice theory by the use of Blackman's numerical-sampling technique. Both room temperature and extrapolated 0°K parameters were used in the calculation. Specific heats, the corresponding Debye characteristic temperatures, and the moments of the distributions were evaluated directly from the frequencies. Comparison is made with experimental data and with other theoretical work. (auth)

5111

NUCLEAR QUADRUPOLE RESONANCES USING IMPURITY MOLECULES AS PROBES. R. Baer and C. Dean (Univ. of Pittsburgh). J. Chem. Phys. 31, 1690-91(1959) Dec.

The nuclear quadrupole resonance of Cl^{35} nuclei was reported previously for p-dichlorobenzene molecules present as an impurity in p-dibromobenzene. The frequency shifts of p-dichlorobenzene in several other compounds were studied. The span of the frequency shift in xylene samples

was in the range of about 530 kc, whereas the span was about 35 kc for the other compounds studied. (B.O.G.)

5112

EXCHANGE OF DEUTERIUM AND HEAVY OXYGEN AMONG HYDROGEN, WATER VAPOR AND OXIDE CATALYSTS OF SPINEL TYPE. Yukio Yoneda, Akio Fujimoto, and Shoji Makishima (Univ. of Tokyo). J. Phys. Chem. 63, 1987-90(1959) Dec.

The exchange of D and O^{18} among H_2, D_2O^{18}, and oxide catalysts of the spinel type, $MgAl_2O_4$, $MgCr_2O_4$, $ZnCr_2O_4$, and $ZnFe_2O_4$ was studied by a flow method. The total exchange rate of hydrogen, R, and that of oxygen, R', were calculated. R'/R of a catalyst was found to be approximately independent of temperature and was about 0.1 for $MgAl_2O_4$ and 0.2 to 0.4 for the other above mentioned catalysts. It was concluded that the common rate-determining step in the exchange of hydrogen and of oxygen in the regeneration of oxygen vacancies in the catalyst is accompanied by the release of water molecules. There is a correlation between the exchange rate and the oxidizing power of the catalyst, i.e., $ZnFe_2O_4 > ZrCr_2O_4 > MgCr_2O_4 > MgAl_2O_4$. The mechanism of hydrogen exchange on the surface of the catalyst is discussed. (auth)

5113

SOLUBILITY OF HYDROGEN FLUORIDE IN MOLTEN FLUORIDES. I. IN MIXTURES OF $NaF-ZrF_4$. J. H. Shaffer, W. R. Grimes, and G. M. Watson (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 1999-2002(1959) Dec.

Solubilities of HF were determined at pressures from 0.5 to 3 atmospheres over a temperature range 550 to 800°C in $NaF-ZrF_4$ mixtures containing 45 to 80.5 mole % NaF. Henry's law is obeyed and the solubility decreases with increasing temperature. The solubility of HF increases approximately tenfold as the mole % of NaF in the solvent is increased from 45 to 80.5 mole %. Henry's law constants in moles HF per cc of solution per atmosphere at 600, 700, and 800°C are $(1.23 \pm 0.04) \times 10^{-3}$ and $(0.93 \pm 0.02) \times 10^{-3}$ and $(0.73 \pm 0.01) \times 10^{-3}$ in $NaF-ZrF_4$ (53 mole % NaF). The enthalpies of solution in kcal per mole also increase in magnitude from −3.85 to −9.70 as the mole % of NaF is changed from 45 to 80.5. The entropies of solution vary from −5.2 to −6.5 eu over the same range of solvent compositions. (auth)

5114

THE "HCl EFFECT" in ANION-RESIN EXCHANGE. Benjamin Chu (Cornell Univ., Ithaca, N. Y.) and Richard M. Diamond (Univ. of California, Berkeley). J. Phys. Chem. 63, 2021-5(1959) Dec.

An explanation is offered for the interesting feature that distribution ratios of anions with strong-base exchange resins are generally lower from concentrated HCl solutions than from comparable LiCl solutions. It is suggested that this behavior is due to the invasion of the resin by non-exchange electrolyte at the high external-solution concentrations and to the partial association of the acid species in the resin phase. That is, because of the nature of the latter phase, normally strong acids are differentiated, the weaker ones partially associating. This does not occur as readily with the lithium salts, and so the preferential association of non-exchange H^+ with the weaker-acid anion (Cl^- in most of the cases studied) represses the absorption of the other anion as a non-exchange electrolyte. If the anion of interest were the anion of a weaker acid than that of the macroelectrolyte, the reverse of the usual behavior should occur, namely, exchange from acid solution should yield larger distribution ratios than exchange from lithium salt solutions. This is shown to be the case for Cl^- tracer exchanging with concentrated HBr and LiBr solutions. (auth)

5115

A STUDY OF THE ZIRCONIUM–HYDROGEN AND ZIRCONIUM–HYDROGEN–URANIUM SYSTEMS BETWEEN 600 AND 800°. Lee D. La Grange, L. J. Dykstra, John M. Dixon, and Ulrich Merten (General Atomic Div., General Dynamics Corp., San Diego, Calif.). J. Phys. Chem. 63, 2035-41(1959) Dec.

The H Zr and H–U–Zr systems were investigated at various temperatures between 600 and 800°C by means of hydrogen-dissociation-pressure measurements in conjunction with high-temperature x-ray diffraction techniques. Phase diagrams deduced from the data are presented. The results on the binary H–Zr diagram are in good agreement with earlier work. A ternary H–U–Zr diagram is proposed which must be considered tentative in several respects. No new phases were encountered that are not already known to exist in the related binary systems. The miscibility gap appearing in the body-centered-cubic solid-solution field of the U–Zr diagram rapidly expands with the addition of hydrogen. The solubility of uranium in the face-centered zirconium–hydride phase is very limited. (auth)

5116

DIFFUSION COEFFICIENTS OF ZIRCONIUM(IV) IN HYDROCHLORIC ACID SOLUTION AT 25°. D. A. Williams-Wynn (Rhodes Univ., Grahamstown, South Africa). J. Phys. Chem. 63, 2065-6(1959) Dec.

The diffusion coefficients of zirconium oxychloride were determined in the supporting electrolyte of sodium nitrate as functions of time (up to 12 weeks), concentration, and acidity (HCl solutions) by the porous glass diaphragm method. (C.J.G.)

5117

POLYMORPHISM OF RARE EARTH DISILICIDES. J. A. Perri, E. Banks, and B. Post (Polytechnic Inst. of Brooklyn). J. Phys. Chem. 63, 2073-4(1959) Dec.

The results of x-ray-diffraction studies of the stability ranges of two polymorphic forms of the tetragonal phase in Eu, Pr, Nd, Sm, Gd, Y, and Dy disilicides are given. $NdSi_2$ appear to be orthorhombic at room temperature. The (101) and (103) reflections of $PrSi_2$ broaden as the temperature is lowered to −120°C and resolve into two peaks indicating the orthorhombic form. Peak broadening was observed in the (200) and (020) reflections of $EuSi_2$ at 150°C indicating onset of the orthorhombic distortion. No comparable broadening of peaks was detected for $LaSi_2$ or $CeSi_2$ at −160°C. Lattice dimensions were determined at the indicated temperatures for $PrSi_2$ (130°C), $SmSi_2$(470°C), $GdSi_2$(460°C), $DySi_2$(585°C), and YSi_2(545°C). (C.J.G.)

5118

A STRUCTURE PROPOSAL FOR $Na_7Zr_6F_{31}$. P. A. Agron and R. D. Ellison (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 2076(1959) Dec.

The space group R3 is proposed for $Na_7Zr_6F_{31}$ crystals with the position (000) suggested for the added Na^+($7NaF \cdot 6ZrF_4$). The refined hexagonal cell size was found to be $a = 13.802 \pm 0.002$A and $c = 9.420 \pm 0.001$A. The corresponding rhombohedral cell unit is $a = 8.565$A and $\alpha = 107°21'$. (C.J.G.)

5119

THE TIN(II) REDUCTION OF METHYL ORANGE. F. R. Duke and N. C. Peterson (Iowa State Univ. of Science and Technology, Ames). J. Phys. Chem. 63, 2076-7(1959) Dec.

The reaction between Sn^{2+} and methyl orange was found to be first order in Sn^{2+} and first order in methyl orange in the presence of chloride at all concentrations. The reduction rates of methyl orange for $SnCl_2$ complexes were calculated. (C.J.G.)

5120

A GLASS CONDUCTANCE CELL FOR THE MEASUREMENT OF DIFFUSION COEFFICIENTS. Herbert S. Harned and Milton Blander (Yale Univ., New Haven). J. Phys. Chem. 63, 2078-9(1959) Dec.

To avoid the disadvantages of the use of Lucite and of grease in the region of electrodes, a glass conductivity cell was designed. The cell is of soft glass tubing, 8-mm diam., and the electrodes are platinum tubes, 2-cm long, 3-mm diam. The cell fabrication is described, and performance test results are given. (D.E.B.)

5121

THE ACTIVITY COEFFICIENT OF HYDROCHLORIC ACID IN THORIUM CHLORIDE SOLUTIONS AT 25°. Herbert S. Harned and Alan B. Gancy (Yale Univ., New Haven). J. Phys. Chem. 63, 2079-80(1959) Dec.

The activity coefficient of hydrochloric acid was computed from measurements of the electromotive force of the cell $H_2/HCl, ThCl_4/AgCl-Ag$. The results are tabulated at constant total ionic strengths of 0.1, 0.5, 1, 3, and 5 at 25°C. (C.J.G.)

5122

THE HYDRODYNAMIC VOLUME OF THE HETEROPOLY HEXAMOLYBDOCOBALTATE(III) ANION FROM VISCOSITY MEASUREMENTS. Michael T. Pope and Louis C. W. Baker (Boston Univ.). J. Phys. Chem. 63, 2083-4(1959) Dec.

The 6-molybdocobaltic acid was prepared by passing an aqueous solution of the purified ammonium salt through an Amberlite IR-120 ion-exchange column in the hydrogen cycle. The effluent acid was concentrated at just below room temperature by placing it in a cellophane sac and blowing a current of warm air over the outside of the sac. The molarity of the resulting solution was determined by analysis of aliquots. A portion of the effluent acid, concentrated at 40° by aspirating dry air through the solution for 48 hours, gave the same viscosity results as the acid concentrated by the cellophane sac method. Viscosity measurements were made in an Ostwald viscometer at 25°. The results of the viscosity determinations are recorded and may be expressed by the Jones–Dole equation. (auth)

5123

THE ACTIVITY COEFFICIENT OF HYDROCHLORIC ACID IN CADMIUM CHLORIDE SOLUTIONS AT 5 M TOTAL IONIC STRENGTH. Herbert S. Harned and Robert Gary (Yale Univ., New Haven). J. Phys. Chem. 63, 2086(1959) Dec.

The activity coefficients of hydrochloric acid in cadmium chloride solutions of 5 M total stoichiometric ionic strength were determined at 25°C from measurements of the cells $H_2/HCl, CdCl_2/AgCl-Ag$. (C.J.G.)

5124

COMPLEX FORMATION CONSTANTS OF LEAD AND CADMIUM IONS WITH CHLORIDE IN FUSED LITHIUM PERCHLORATE. Frederick R. Duke and Walter W. Lawrence (Iowa State Univ. of Science and Technology, Ames). J. Phys. Chem. 63, 2087-8(1959) Dec.

Complex formation constants for lead and cadmium ions with chloride ion were determined in a fused KNO_3-NaNO_3 eutectic and compared with the formation constants in a nitrate solvent. (D.E.B.)

5125

INFLUENCE OF CRYSTAL DEFECTS ON THE SZILARD-CHALMERS PROCESS IN SOLIDS. A. G. Maddock and J. I. Vargas (University Chemical Labs., Cambridge, Eng.) Nature 184, Suppl. 25, 1931(1959) Dec. 19.

Results are reported from measurements on single crystals and powdered potassium chromate prepared from the same batch of crystals and subjected to thermal neutron irradiation. The powder underwent a much more rapid thermal annealing than the single crystals. The effects of crushing and pre-irradiation of the single crystals on retention were measured. A comparison was made of the retention and thermal annealing of samples of normal lithium chromate with a sample containing only lithium-7. Data are presented graphically. It is concluded that the results clearly establish a relation between the crystal defects or inactive damage centers in the crystal and the behavior of the recoil fragments. (C.H.)

5126

INCORPORATION OF RADIO IRON IN ERYTHROCYTES OF X-IRRADIATED DORMICE. Hans A. Kunkel (Universitäts-Frauenklinik, Hamburg). Naturwissenschaften 46, 627-8 (1959). (In German)

Four groups of experimental mice were used: (a) not-hibernating unirradiated controls, (b) mice irradiated in the not-hibernating condition to 800 γ, (c) hibernating unirradiated controls, and (d) hibernating, irradiated mice. The animals were given intraperitoneal injections of 1 μc of Fe^{59}-labeled ferric saccharate solution. Groups (b) and (d) were injected immediately after irradiation. The blood levels of Fe^{59} were followed in all animals for 8 days after injection. Group (a) being considered 100%, the other groups had only 8, 10, and 4% erythrocyte activity, respectively. The drop in erythrocyte activity can be attributed only to a radioinduced mitotic disturbance in the bone marrow. (T.R.H.)

5127

SORPTION OF URANIUM AS CYANATO COMPLEX. Max Ziegler (Universität, Göttingen Ger.). Naturwissenschaften 46, 629(1959). (In German)

The uranyl cyanato complex prepared by addition of KCN to a uranyl salt solution is yellower than the uranyl salt solution used. The sorption rate on anion exchange resins (Dowex 1 × 8 chloride-form) is surprisingly great. This sorption is not affected by the presence of $(NH_4)_2CO_3$ so that U separations of interest in ore processing are possible. (T.R.H.)

5128

SOME STUDIES OF AQUEOUS URANIUM OXIDE SLURRIES. Robert S. Hansen, Robert E. Minturn, and Bert H. Clampitt (Iowa State Univ. of Science and Tech., Ames). Nuclear Sci. and Eng. 6, 458-60(1959) Nov.

Aqueous slurries of uranium compounds were studied in connection with their possible use as reactor fuels. The preparation and properties of seven slurries studied are listed. Slurry pH could be adjusted within the range 6 to 11 without appreciable effect on stability, but rapid flocculation occurred at pH values below 5. (B.O.G.)

5129

THEORY OF FERROMAGNETIC RESONANCE IN RARE EARTH GARNETS. II. LINE WIDTHS. P. G. de Gennes, C. Kittel, and A. M. Portis (Univ. of California, Berkeley). Phys. Rev. 116, 323-30(1959) Oct. 15.

The spins of rare earth ions in the garnets are coupled strongly both to the lattice phonons and, by an exchange interaction, to the ferric spin lattice. The rare earth spins thus provide a powerful relaxation channel for the ferric

lattice. Two contributions to the line width may be distinguished: a coherent process (in which the total magnetic moment of the ferric lattice relaxes without changing the magnitude of the moment) is dominant at temperatures from 0°K up to just below the Curie temperature. Near and above T_c a fluctuation process (in which ferric spins flip locally) is dominant. The theoretical results describe the order of magnitude and the temperature dependence of the observed line widths in the rare earth garnets and in impure yttrium iron garnet, if one assumes in the absence of direct experimental knowledge that the relaxation frequency $1/\tau$ of the relevant rare earth ions is $\sim 10^{-12}$ sec at 400°K. As the temperature is increased from 0°K, the width increases until a maximum is reached when $1/\tau$ becomes comparable with the ferric-rare earth exchange frequency. Above this temperature the width decreases until near T_c, where there is a sharp rise. (auth)

5130

SELF-DIFFUSION IN LIQUID He^3. H. R. Hart, Jr. and J. C. Wheatley (Univ. of Illinois, Urbana). Phys. Rev. Letters 4, 3-5(1960) Jan. 1.

The self-diffusion coefficient of liquid He^3 was measured in the temperature range 0.067 to 2.97°K at pressures near the saturated vapor pressure. Methods for measuring the self-diffusion coefficients were discussed. The results indicate that the diffusion coefficient goes through a minimum near 0.55°K and increases rapidly below 0.2°K. (B.O.G.)

5131

AN ABSOLUTE DETERMINATION OF THE VISCOSITY OF ELEVEN GASES OVER A RANGE OF PRESSURES. J. Kestin (Brown Univ., Providence) and W. Leidenfrost (Forschunginstitut Verfahrenstechnik der G.V.T. Aachen). Physica 25, 1033-62(1959) Nov. (In English)

The measurements described were based on a new theory of the oscillating-disk viscometer which includes the effect of the finite radius as well as that of its cylindrical circumference. The theory is first compared with very precise measurements obtained in an instrument whose brief description is also given. The experiments verify the theory to within 0.15% when no correction for the paddle effect of the mirror is applied. The latter was determined empirically with respect to measurements on air and with it, it is permissible to assume that the theory holds exactly when the boundary layer thickness is large enough, as assumed in Newell's theory. The precise lower bound of the boundary layer thickness for which Newell's theory is applicable was determined experimentally with reference to measurements on nitrogen. The final measurements performed at 20°C for air, argon, carbon dioxide, deuterium, helium, hydrogen, krypton, neon, nitrogen, oxygen, and water vapor, and, in addition, at 20°C for air, argon, nitrogen, oxygen, and xenon are believed to be accurate, on an absolute basis, to 0.05% and precise to 0.01 to 0.07% depending on the gas. A thorough statistical analysis of the present measurements and those due to Michels and Gibson on nitrogen is given. This shows that apart from being subject to a much larger standard deviation, the latter results are statistically identical with the present measurements over the same range of pressures. It is, consequently, believed that the reliability of both sets of data is very high because they were obtained by entirely different methods. Extensive numerical results and interpolation formulas are given. (auth)

5132

SPECIFIC HEATS OF LITHIUM ISOTOPES FROM 20° TO 300°K. Douglas L. Martin (National Research Council, Ottawa). Physica 25, 1193-9(1959) Nov. (In English)

Measurements on lithium metal containing 99.3% Li^6 are reported. The details of the martensitic transformation appear to be very similar to those for lithium with natural isotopic composition. These measurements together with other recent results for Li^7 rich metal are analyzed to give approximate values for the pure isotopes. The results are in accord with theoretical expectations. (auth)

5133

PARAMAGNETIC RESONANCE OF Yb^{3+} IN YTTRIUM GALLIUM GARNET. D. Boakes, G. Garton, D. Ryan, and W. P. Wolf (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 74, 663-5(1959) Nov. 1.

The paramagnetic resonance was observed of approximately 1% Yb^{3+} in crystals of $Y_3Ga_5O_{12}$. The results are of interest in connection with the magnetic properties of $Yb_3Ga_5O_{12}$, $Yb_3Fe_5O_{12}$, and the effects of rare earth impurities in $Y_3Fe_5O_{12}$. The crystals were grown from a PbO flux using the method of Nielsen and were oriented by optical and x-ray methods. Measurements were made at 9 gigacycles per second, using a standard video spectrometer, at temperatures of 4°, 20°, and 90°K. When a magnetic field was applied in a general direction relative to the crystal axes six main lines were clearly resolved, together with a large number of smaller lines which were later identified as hyperfine structure due to Yb^{171} and Yb^{173} A plot of curves calculated from g values reveals a variation of resonance field with angle in a (1 1 0) plane at 9.677 gigacycles per second. (B.O.G.)

5134

MAGNETIC PROPERTIES OF RARE EARTH IONS IN GARNETS. W. P. Wolf (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 74, 665-7(1959) Nov. 1.

The magnetic properties of isostructural $Yb_3Ga_5O_{12}$, $Yb_3Fe_5O_{12}$, and $Y_3Fe_5O_{12}$, with small impurities of rare earths, are discussed on the basis of implications from paramagnetic resonance studies of Yb^{3+} ions in yttrium gallium garnet The susceptibility and saturation magnetization to be expected may be calculated from the measured g-values Equations for the determination of the saturation magnetic moment and the anisotropy energy were derived. It was assumed that crystal field splittings were large compared with exchange effects and that each rare earth ion was in a doublet ground state. (B.O.G.)

5135

ON THE DISTRIBUTION OF URANYL NITRATES BETWEEN AQUEOUS SOLUTIONS AND SOME SIMPLE AND COMPLEX ETHERS. V. M. Vdovenko and E. A. Smirnova Radiokhimiya 1, 43-51(1959). (In Russian)

The distribution of uranyl nitrate between aqueous solutions and a series of simple and complex ethers follows the formulas $UO_2(NO_3)_2 \cdot hH_2O \rightleftharpoons UO_2^{2+} + 2NO^- + hH_2O$ and $\log m\gamma a_w^{h/3} = \frac{1}{3} \log K_1 + \frac{1}{3} \log m_\mu$. The equilibrium constants, activity factors, and molar volumes were determined. (R.V.J.)

5136

THE CONDITION OF MICROQUANTITIES OF RADIOELEMENTS IN SOLUTIONS. VI. THE CONDITION OF NIOBIUM IN AQUEOUS SOLUTIONS. I. E. Starik and I. A. Skul'skii. Radiokhimiya 1, 77-81(1959). (In Russian)

The condition of niobium in nitric acid solutions with concentration 10^{-11} g-atom/l was investigated. Studies of adsorption by quartz and of the effects of ultrafiltration and centrifugation indicate that in solutions with pH < 2 the niobium is in an ionic state; with pH > 2, true colloidal solutions of niobium are formed. Also with pH < 2, positively and negatively charged niobium ions exist simultaneously. (R.V.J.)

5137

FORMATION OF ANOMALOUS MIXED CRYSTALS RaF_2–LaF_3 IN LANTHANUM FLUORIDE CRYSTALLIZATION IN MELTS. V. R. Klokman and A. A. Mel'nikova. Radiokhimiya 1, 241-6(1959). (In Russian)

The formation of anomalous mixed crystals of RaF_2–LaF_3 in melts was studied in LaF_3–RaF_2–RbF and LaF_3–RaF_2–KF systems. An enrichment by solid phase microcomponents was observed during the radium redistribution between the melt and crystals. The absence of a lower miscibility boundary in the formation of crystals is explained by the presence of admixtures of potassium in the initial salt. It was found that the crystallization factor of radium in the systems depends on the chemical nature of the second component. A larger radium crystallization factor in LaF_3–RaF_2–RbF than in LaF_3–RaF_2–KF is due to the reduced activity of macrocomponent ions and the presence of unbroken molecules of the more stable compound $RbLaF_4$. (R.V.J.)

5138

DISTRIBUTION OF ThB BETWEEN THE MELT AND CRYSTALS OF ALKALI METAL HALIDES. V. R. Klokman, G. P. Lovtsyus, and A. A. Mel'nikova. Radiokhimiya 1, 247-52(1959). (In Russian)

The distribution of ThB between the melt and crystals of LiCl, KCl, NaCl, and KBr was studied in the systems LiCl–KCl, NaCl–$LiNO_3$, and KBr–KNO_3. It was observed that during crystallization from the melt the ThB is not captured by the alkali metal halides. It is postulated that the unique behavior of lead in the solution and melt is the result of a strong dependence of the crystallization factor on temperature. (R.V.J.)

5139

SOLUBILITY OF POLONIUM HYDROXIDE. D. M. Ziv and I. A. Efros. Radiokhimiya 1, 290-94(1959). (In Russian)

The mean solubility of polonium hydroxide is $(3.7 \pm 1.5) \times 10^{-5}$ mole/l. The solubility product is $L_{Po(OH)_4} = 10^{-37}$. (R.V.J.)

5140

PREPARATION AND PROPERTIES OF URANO-OXALIC ACID SALTS WITH RARE EARTHS. A. A. Grinberg, G. I. Petrzhak, and L. I. Evteev. Radiokhimiya 1, 300-308 (1959). (In Russian)

The lanthanum and cerium salts of urano-oxalic acid complexes, $KLa[U(C_2O_4)_4] \cdot 8H_2O$ and $KCe[U(C_2O_4)_4] \cdot 8H_2O$, were synthesized. The salts, stable in a solid state, slowly disintegrate in solution. (R.V.J.)

5141

SPECTROPHOTOMETRIC STUDIES OF NEPTUNYL ION COMPLEX FORMATION WITH ACETATES. M. P. Meford'eva, P. I. Artyukhin, and A. D. Gel'man. Radiokhimiya 1, 309-16(1959). (In Russian)

Spectrophotometric studies were made of neptunyl ion–acetate ion systems in perchloric acid. Complexes of $NpO_2Ac_2^+$ and $NpO_2Ac_3^-$ were formed. The formation constants were calculated for neptunyl diacetate and triacetate. (R.V.J.)

5142

DETERMINATION OF RELATIVE MOBILITY OF BARIUM AND RADIUM IONS. B. P. Kiselev. Radiokhimiya 1, 360-63(1959). (In Russian)

The relative mobility of radium and barium ions was studied in a mixture of radium–thorium X and mesothorium I. For infinite dilution, the relative mobility difference was found to be about 3% with electrolyte concentration 2 g equiv/l. For radium and barium it is 7% and for barium and actinium nearly 2.5%. (R.V.J.)

5143

DETERMINATION OF THE COMPOSITION AND STABILITY CONSTANT OF CERIUM OXALATE COMPLEXES BY ION EXCHANGE. K. B. Zaborenko, A. V. Zaval'skaya and V. V. Fomin. Radiokhimiya 1, 387-90(1959). (In Russian)

Studies of cerium ion distribution between cations (KU-2) and solution with or without $C_2O_4^{2-}$ complexing revealed the presence of $CeC_2O_4^+$ ions with a stability constant $\beta_1 = 1.1 \times 10^4$ in the solution with unit ion force. (R.V.J.)

5144

ACID DISSOCIATION OF PROTACTINIUM AQUEOUS COMPLEXES. V. A. Mikhaĭlov. Radiokhimiya 1, 395-9 (1959). (In Russian)

An estimate was made of the dissociation constants of protactinium aqueous complex with diisoamylphosphoric acid, and some considerations are offered on the inconclusiveness of ionic force rules. (R.V.J.)

5145

USE OF ION-EXCHANGE RESINS IN STUDIES OF ZIRCONIUM ION CHARGE VARIATIONS IN NITRIC ACID. A. M. Trofimov and L. N. Stepanova. Radiokhimiya 1, 403-7(1959). (In Russian)

Variations in the ion charge are determined by means of ion-exchange resins with various absorption abilities. The variation is determined in relation to the acidity of the solutions. (R.V.J.)

5146

THE STATE OF MICROQUANTITIES OF RADIOELEMENTS IN SOLUTIONS. XI. ELECTROPHORETIC MOTION OF POLONIUM IN AQUEOUS SOLUTIONS. I. E. Starik and N. I. Ampelogova. Radiokhimiya 1, 414-18(1959). (In Russian)

Anion polonium is prevalent in 0.1N HCl; about 30% cations are found. The isoelectric point of cation and anion equilibrium is found at pH 2 to 3; the second isoelectric point, corresponding to polonium colloid particle coagulation, is at 0.01N KOH. The cations of polonium, sorbed by negative charged impurities, are prevalent at pH 5 to 7. In 0.1N KOH and above, anion polonium is found as PoO_3^{2-}. (R.V.J.)

5147

STATE OF MICROQUANTITIES OF RADIOELEMENTS IN SOLUTIONS. XII. DETERMINATION OF POLONIUM STATE IN AQUEOUS SOLUTION BY ELECTROCHEMICAL METHOD. I. E. Starik and N. I. Ampelogova. Radiokhimiya 1, 419-24(1959). (In Russian)

Polonium chloride hydrolysis occurs in two steps: $Po^{4+} + 2H_2O \rightarrow Po(OH)_2^{2+} + 2H^+$ at pH = 3.3 and $Po(OH)_2^{2+} + 2H_2O \rightarrow Po(OH)_4 + 2H^+$ at pH = 7.8. At pH 8 to 11 the deposition of polonium on copper is at a minimum. The solubility of polonium hydroxide is 6×10^{-39} (complete dissociation). Polonium is easily extracted by copper in acid media (0.01 to 1N HCl) and in alkali media (0.01 to 0.1N KOH); however, with increased concentration of alkali up to 1N deposition tends to decrease due to polonium transition into anion PoO_3^{2-}. (R.V.J.)

5148

THE STATE OF MICROQUANTITIES OF RADIOELEMENTS IN SOLUTIONS. XIII. ULTRAFILTRATION AND GLASS ADSORPTION METHODS FOR DETERMINING THE STATE OF POLONIUM IN AQUEOUS SOLUTIONS. I. E. Starik and N. I. Ampelova. Radiokhimiya 1, 425-9(1959). (In Russian)

Experiments on polonium adsorption by glass and ultrafiltration through cellophane and biological ultra-

filters indicate cellophane retention starting at pH = 2; at pH 6.5 to 13 the retention is somewhat higher. The maximum retention by biological filters is reached with pH = 7; at pH 7 to 10 most of the polonium passes through the filter. Chloride and caustic potash aqueous solutions, with pH from 1 to 13 and polonium concentration from 0.7 to 1.3 $\times 10^{-12}$ mole/l, were used in the experiments. Adsorption on glass was quite active at pH 2 to 7.5 with a sharp maximum at pH 4.8 to 5.5. A large-particle pseudo-colloidal phase was found in the pH range 5 to 7. Negatively charged fine dispersion particles of insoluble polonium (the products of hydrolysis) are predominant at pH 8 to 11. In 0.1N KOH(pH = 13) polonium occurs as anion PoO_3^{2-} and is not adsorbed by negatively charged glass. In some cases impurities caused an anomously high adsorption. (R.V.J.)

5149

THE STATE OF MICROQUANTITIES OF RADIOELEMENTS IN SOLUTIONS. XIV. INVESTIGATION OF AMERICIUM IN AQUEOUS SOLUTIONS. I. E. Starik and F. L. Ginzburg. Radiokhimiya 1, 435-8(1959). (In Russian)

The adsorption of Am by quartz glass was studied as a function of pH. The maximum adsorption from nitric acid solutions with americium concentration 10^{-9} M is found at pH 6.5 to 7.0. Microquantities of colloidal americium were determined by ultrafiltration. The adsorption, desorption, and ultrafiltration data indicate predominantly ion dispersion americium in solutions with pH 1 to 4.5. An increase of pH tends to enhance hydrolysis, and with pH > 7 leads to colloidal particle formation. (R.V.J.)

5150

THE ION EXCHANGE METHOD IN STUDIES OF THE STATE OF MATTER IN SOLUTION. VI. COMPLEXING RUTHENIUM(IV) IN HYDROCHLORIC AND PERCHLORIC ACIDS. V. I. Paramonova and E. F. Latyshev. Radiokhimiya 1, 458-64(1959). (In Russian)

Investigations of "deep" ruthenium hydrolysis revealed that hydrolysis takes place in solutions with total salt concentration of 1M when the acidity is less than 0.05M. Ruthenium(IV) complex formation in HCl and in systems composed of HCl and $HClO_4$ was studied. Calculations of the instability constant of $[Ru(OH)_2Cl_2]^0$ complex show a magnitude of $(1.6 \pm 0.3) \times 10^{-4}$ with $\mu = 1$. The instability constant of $[Ru(OH)_2Cl_4]^{2-}$ with dissociation to the neutral state has a magnitude of 4.3 ± 0.7 with $\mu = 1$. The common instability constant for $[Ru(OH)_2Cl_4]^{2-}$ is $(0.7 \pm 0.2) \times 10^{-2}$ with $\mu = 1$. (R.V.J.)

5151

CO-PRECIPITATION OF La^{140}, Pm^{147}, AND Y^{91} WITH TETRAVALENT CERIUM IODATES. V. P. Shvedov and Sh. A. Musaev. Radiokhimiya 1, 465-74(1959). (In Russian)

The carrier-free co-precipitation of La^{140}, Pm^{147}, and Y^{91} with tetravalent cerium iodate was investigated. Isotope purity was checked by La^{140} decay and by the maximum energy of Pm^{147} and Y^{91} β particles. The reagents were purified and solutions were prepared using twice-distilled water. Measurements were taken with a front window counter with a statistical order of error of 1 to 5% depending on the activity of the specimen. (R.V.J.)

5152

ADSORPTION OF MICROQUANTITIES OF THORIUM BY ASH-FREE ACTIVATED PLATINIZED COAL. V. A. Paramonova, A. N. Mosevich, and N. V. Goryanin. Radiokhimiya 1, 475-81(1959). (In Russian)

It is shown that in solutions with HCl > 0.05 N, thorium is not adsorbed by coal in air or hydrogen atmospheres. Hydrolyzed thorium is found in low acidity (<0.05 N) solutions; the degree of hydrolysis is a function of pH. In the latter case thorium is adsorbed by coal in air or hydrogen; however, the adsorption is non-reversible and poorly reproducible. Adsorption of negative tartrate or oxalate thorium complexes is electrostatic in character. A sufficiently complete coal adsorption of thorium can be achieved in air and can be quantitatively desorbed in hydrogen. (R.V.J.)

5153

HIGH-TEMPERATURE PRESSURE-VACUUM FURNACE. William Lodding and Laurence Hammell (Rutgers Univ., New Brunswick, N. J.). Rev. Sci. Instr. 30, 885-6(1959) Oct.

A simple high-temperature pressure-vacuum furnace using a recrystallized alumina tube as the vessel with external resistance windings is described. Temperatures to 1900°C can be used in both strongly reducing and oxidizing atmospheres. Pressures to 28 atmos at 1200°C were obtained and no water cooling was required. Differential thermal analysis with continuous gas analysis of reaction products is made possible. (auth)

5154

SIMPLE DEMOUNTABLE INDIUM O-RING SEAL TIGHT TO He II. Hajime Seki (Univ. of Pennsylvania, Philadelphia). Rev. Sci. Instr. 30, 943-4(1959) Oct.

An indium O-ring was used to seal an isolated chamber to liquid He II at 10^{-5} mm Hg, and no appreciable change in pressure was detected as the λ point was passed. The O-ring was chosen for economy of space, to avoid the soldering of flanges onto the copper tube, and ease of disassembly. It is expected that this design will be applicable to various optical experiments which require sample isolation and good temperature control. (B.O.G.)

5155

CRYSTALLOGRAPHIC CHARACTERISTICS OF ZIRCONIUM ORTHOPHOSPHATE $Zr_3(PO_4)_4$. Aurelio Burdese and Maria Lucco Borlera (Politecnico, Turin). Ricerca sci. 29, 2337-8(1959) Nov. (In Italian)

X-ray diffraction data on zirconium orthophosphate $Zr_3(PO_4)_4$. The compound $Zr_3(PO_4)_4$ is monoclinic, with the following lattice constants: $a_0 = 9.16$ Å; $b_0 = 9.11$ Å; $c_0 = 7.92$ Å; $\beta = 107° 20'$. (auth)

5156

DETERMINATION OF DIFFUSION FACTOR OF CERTAIN SELENIUM IONS BY β-RAY ADSORPTION METHOD. A. A. Kuliev. Trudy Inst. Fiz. i Mat. Akad. Nauk Azerbaĭdzhan. S.S.R., Ser. Fiz. 9, 5-9(1958). (In Russian)

The temperature dependence of the diffusion of strontium, iron, and zinc in hexagonal selenium is determined by an adsorption method in which the active radioisotopes are deposited on one side of the specimen and the intensity of radiation from both sides is measured as a function of annealing time. Diffusion coefficients for various temperatures are tabulated and correlated. The results show that the diffusion factor for strontium is smaller than for zinc and iron. (R.V.J.)

Analytical Procedures

5157 AERE-AM-59

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div. Woolwich Outstation, England.

THE DETERMINATION OF IRON IN LOW GRADE URANIUM ORES. A. Parker. July 1959. 5p. BIS.

The finely ground ore is digested in aqua regia and fumed with sulfuric acid. The iron is reduced and titrated with standard potassium dichromate solution. (auth)

5158 AERE-C/R-617

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ESTIMATION OF URANIUM IN TRIBUTYL PHOSPHATE SOLUTIONS. E. Furby and G. J. Ashworth. Dec. 1950. Changed from OFFICIAL USE ONLY Dec. 29, 1959. 12p.

Estimation of uranium in tributyl phosphate solutions by the standard hydrogen peroxide colorimetric method is discussed, and experimental details of the method are given. An alternative procedure by means of thiocyanate is also described, and some comparisons are drawn. The methods discussed are suitable for quantities of uranium down to 200 micrograms in the presence of the tributyl phosphate dissolved in the aqueous extracting solutions. (auth)

5159 APEX-243

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

DETERMINATION OF HYDROGEN IN SOLID HYDRIDE COMPOUNDS BY USE OF INDUCTION HEATING. R. A. Dunleavy, M. R. Menke, and E. W. Rebol. Jan. 9, 1956. Decl. Oct. 26, 1959. 8p. Contracts AF33(600)-38062 and AT(11-1)-171. OTS.

A rapid and precise method for the determination of hydrogen in solid hydride compounds is described. The sample is thermally decomposed in a helium atmosphere with a high frequency combustion unit, the evolved hydrogen oxidized to water with hot copper oxide, and the resulting water vapor absorbed in magnesium perchlorate. From the weight of the absorbed water the hydrogen content of the sample is calculated. This rapid and simple method is especially suited for routine control work. The average time of one determination is approximately twenty minutes. The average error of deviation was calculated as 0.03 per cent hydrogen. (auth)

5160 GAT-289

Goodyear Atomic Corp., Portsmouth, Ohio.

A COLORIMETRIC METHOD FOR RAPID DETERMINATION OF TRACES OF SELENIUM. E. M. Ray. Dec. 15, 1959. 11p. Contract AT(33-2)-1. OTS.

A colorimetric method for the rapid determination of selenium in 5- to 50-microgram quantities is described. Selenium (IV) and (VI) in water solution are reduced by hydrochloric and hydriodic acids, respectively, to elementary selenium which forms a colored complex with the liberated iodine. Excess iodine produced in side reactions combines with phenol. Results may be duplicated with a precision of about ±10 percent. The effects of oxidants, reductants, precipitants, and other sources of interferences were studied. Of those investigated, only tellurium causes serious difficulty. (auth)

5161 IGO-AM/S-201

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE VOLUMETRIC DETERMINATION OF ZIRCONIUM IN URANIUM–ZIRCONIUM MASTER ALLOY. Mar. 3, 1959. 6p.

The sample is dissolved in HF–HNO_3 solution. After heating the solution with H_2SO_4 and adding HCl, Zr is precipitated with mandelic acid. Zr is determined volumetrically in a H_2SO_4 solution of the precipitate using standard disodium ethylenediaminetetra-acetate and iron solutions. (J.R.D.)

5162 KAPL-2062

Knolls Atomic Power Lab., Schenectady, N. Y.

RELIABILITY OF MASS SPECTROMETRIC DETERMINATIONS OF BORON ISOTOPE ABUNDANCE. W. O. Haas, Jr., F. M. Rourke, J. L. Mewherter, and P. H. McDonald. Oct. 2, 1959. 15p. Contract W-31-109-Eng-52. OTS.

No statistically significant bias in the determination of boron isotope abundance was observed in 22 mass spectrometric analyses of four carefully prepared standards at nominal B^{11}/B^{10} ratios of 1:1 and 4:1. The uncertainty in a single determination (including precision and a possible bias of as much as ±0.4%) in this range is ±1.3% of the ratio at the 95% confidence level for carefully handled, clean samples when a comparable amount of data is obtained. This corresponds to ±1 relative per cent uncertainty in measuring the B^{10} abundance of natural boron. This uncertainty in measurement of the abundance can be reduced by making multiple runs on a sample but is limited by the uncertainty concerning bias. The samples were run as sodium tetraborate in the KAPL single-stage mass spectrometer best adapted for the purpose. (auth)

5163 LA-2362

Los Alamos Scientific Lab., N. Mex.

THE DETERMINATION OF CHLORINE IN POLYURETHANE PLASTIC. A. L. Henicksman, E. H. VanKooten, R. D. Gardner, and W. H. Ashley. Oct. 1959. 11p. Contract W-7405-eng-36. OTS.

Chlorine may be determined in polyurethane by gravimetric or spectrophotometric techniques. The sample is burned in a special combustion tube with two oxygen inlets, the products of combustion are absorbed in a solution containing sodium hydroxide and hydrogen peroxide, and the chlorine is measured either gravimetrically as silver chloride or spectrophotometrically using mercuric thiocyanate and ferric perchlorate. Eighteen determinations of chlorine in known solutions of sodium chloroacetate or perchloric acid gave an average recovery of 98.3% with a standard deviation of 2.8%. (auth)

5164 NP-8160

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

INDIREKTE METHODEN IN DER FLAMMENANALYSE. TEIL II. Bericht No. 110/VIII. (Indirect Methods in Flame Analysis. Part II). Report No. 110/VIII. J. Malinowski, W. Rutkowski, and S. Szymczak. Sept. 1959. 7p.

A Zeiss Model III flame photometer with an acetylene–air flame was used to study the effects of SeO_3^{2-}, $H_4TeO_6^{2-}$, TiF_6^{2-}, and Ti^{4+} on Ca or Ti emission. It was established that the emission suppression is caused by the production of heavy ions which can be excited. Measurements were also made with the Hilger "Uvispek" with H_2–O_2 flame apparatus, to determine the effect of flame temperature on emission disturbance. (tr-auth)

5165 PGR-10(8)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.

ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF IRON IN VANADIUM. 1959. 5p. BIS.

After dissolution of the sample in HCl/HNO_3 solution, the iron is reduced with hydroxylamine hydrochloride and extracted into nitrobenzene as its phenanthroline complex and determined absorptiometrically. (auth)

5166 PGR-14(S)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.
ANALYTICAL METHOD FOR THE DETERMINATION OF COPPER IN URANIC MATERIALS. Oct. 26, 1959. 8p. BIS.

Copper is separated at pH 2.0 to 2.5 by shaking with a chloroform solution of dithizone. After destruction of the organic extract the copper is determined absorptiometrically either with ammonia or diethyldithiocarbamate. (auth)

5167 PGR-16(S)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.
ANALYTICAL METHODS FOR THE ABSORPTIOMETRIC DETERMINATION OF IRON IN ZIRCALOY 2. Aug. 28, 1959. 7p. BIS.

The sample is dissolved in hydrofluoric acid. The fluoride is complexed with boric acid and zirconium with ammonium citrate. The iron is complexed with thioglycolic acid and determined absorptiometrically in ammoniacal solution. (auth)

5168 PGR-19(S)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.
ANALYTICAL METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF LEAD IN ZIRCONIUM METAL. Aug. 28, 1959. 8p. BIS.

Lead is extracted with dithizone from an ammoniacal citrate solution containing cyanide and hydroxylamine. The excess dithizone is removed by an ammonium cyanide wash and the lead dithizonate measured absorptiometrically. (auth)

5169 PGR-23(S)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.
ANALYLICAL METHOD FOR THE VOLUMETRIC DETERMINATION OF URANIUM IN CORNISH ORES. Oct. 26, 1959. 13p. BIS.

The sample is treated with nitric acid. Insoluble material is treated with hydrofluoric acid followed by a sodium hydroxide fusion, and then treated with nitric acid. Uranium is separated from the nitric acid solution by continuous ether extraction. After removal of iron and conversion of the uranium to the sulfate, the uranyl solution is reduced and titrated with potassium dichromate. (auth)

5170 PGR-29(S)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.
ANALYTICAL METHODS FOR THE ABSORPTIOMETRIC DETERMINATION OF NICKEL IN ZIRCALOY 2. Aug. 28, 1959. 6p. BIS.

The alloy is dissolved in dilute hydrofluoric acid. Ammonium citrate is added to complex the zirconium, and the pH of the solution is adjusted approximately to pH 8. The nickel dimethyl glyoxime complex is extracted into chloroform, then back extracted into dilute hydrochloric acid. The oxidized dimethyl glyoxime complex is formed and measured absorptiometrically. (auth)

5171 PGR-31(S)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.
ANALYTICAL METHODS FOR THE AMPEROMETRIC DETERMINATION OF CHLORIDE IN BERYLLIUM METAL. Sept. 9, 1959. 9p. BIS.

The metal is dissolved in sulfuric acid by heating under reflux. The chloride is determined by amperometric titration with 0.01 N nitrate solution. (J.R.D.)

5172 PGR-38(S)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.
ANALYTICAL METHOD FOR THE DETERMINATION OF GOLD, PLATINUM, PALLADIUM IN PITCHBLENDE ORE (above 40% U_3O_8) AND BARIUM SULPHATE CONCENTRATES FROM PITCHBLENDE ORE. 1959. 15p. BIS.

The sample is fused with a silicate flux containing a reducing agent and litharge. The lead button produced is scorified and cupelled leaving a bead of precious metal. The bead is parted with nitric acid and the gold annealed and weighed. The gold is dissolved in aqua regia and combined with the parting liquid and the silver chloride filtered off. Gold is separated by ethyl acetate extraction and palladium by chloroform extraction of the dimethyl glyoxime complex. Platinum is then removed by ethyl acetate extraction after reduction with stannous chloride. The platinum is back extracted with sodium chloride solution and titrated with dithizone. The palladium extract is wet oxidized and the palladium titrated with dithizone. (auth)

5173 PGR-42(CA)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Capenhurst, Ches., England.
ANALYTICAL METHOD FOR THE DETERMINATION OF THE ALPHA-ACTIVITY DUE TO URANIUM IN AQUEOUS EFFLUENT. Aug. 17, 1959. 8p. BIS.

The sample is evaporated to dryness in the presence of nitric acid. Uranium is extracted from the residue using di-ethyl ether and ammonium nitrate salting-out reagent. The α-activity is then determined using an α-scintillation counter. The limit of detection of the method is 30 dpm per liter sample. (auth)

5174 PGR-43(CA)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Capenhurst, Ches., England.
ANALYTICAL METHOD FOR THE DETERMINATION OF ALPHA-ACTIVITY DUE TO URANIUM IN MILK. Aug. 17, 1959. 8p. BIS.

A sample of the milk is wet oxidized and evaporated to dryness. Uranium is extracted from the residue using di-ethyl ether and ammonium nitrate salting-out reagent. The α-activity is then determined using an α-scintillation counter. The method is applicable to the determination of the α-activity of milk at a level of not less than 10 dpm per liter. (auth)

5175 PGR-44(CA)
United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Capenhurst, Ches., England.
ANALYTICAL METHOD FOR THE DETERMINATION OF FLUORIDE IN SCRUBBER EFFLUENT GASES. Aug. 17, 1959. 8p. BIS.

A sample of the gas is passed through a series of absorbers containing nitric acid solution, sodium hydroxide solution, and water. The fluoride absorbed is steam distilled from the solution and determined by titration with thorium nitrate solution using alizarin red S as indicator. The method is applicable to the determination of fluoride in samples of effluent gas from scrubber systems. Concentrations between 0.5 and 25 mg of fluoride per m^3 of sample can be determined. Concentrations outside this range may be determined by suitable adjustment of the sample aliquot. (auth)

5176 PGR-45(CA)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Capenhurst, Ches., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF CHLORIDE IN SCRUBBER EFFLUENT GASES. Aug. 17, 1959. 6p. BIS.

The gas sample is passed through absorbers containing nitric acid, sodium hydroxide, and water. An aliquot is titrated with mercuric nitrate using sodium nitroprusside as indicator. (auth)

5177 PGR-46(CA)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Capenhurst, Ches., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF URANIUM IN SCRUBBER EFFLUENT GASES. Aug. 18, 1959. 7p. BIS.

The sample of gas is passed through a series of absorbers containing nitric acid solution, sodium hydroxide solution, and water. The uranium absorbed is determined absorptiometrically as the ammonium thiocyanate complex. The method is applicable to the determination of uranium in samples from incinerator flue stacks and the effluent gases from scrubber systems. Concentrations between 0.05 and 3.0 mg of uranium per m^3 of gas can be determined. Concentrations outside this range may be determined by suitable adjustment of the sample aliquot. (auth)

5178 PGR-47(CA)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Capenhurst, Ches., England.

ANALYTICAL METHOD FOR THE DETERMINATION OF THE U-238/U-235 ISOTOPE RATIO OF URANIUM HEXAFLUORIDE BY THE MS2 MASS SPECTROMETER (SINGLE COLLECTION TECHNIQUE). Aug. 18, 1959. 17p. BIS.

The sample in the form of uranium hexafluoride is admitted to the ion source of the mass spectrometer. The beams of mass 330 and mass 333 are scanned over the collector, and their sizes compared to give a ratio. This figure is corrected for background and resolution to give an isotopic ratio. (auth)

5179 PGR-49(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

A SIMPLE X-RAY FLUORESCENCE SPECTROMETER FOR SOLUTION ANALYSIS. B. J. McDonald. Aug. 12, 1959. 19p. BIS.

Work carried out to assess the potentialities of x-ray fluorescence spectrography as an analytical tool at C.S.D. Windscale is described. The construction and operation of a film recording spectrograph are described. It is found to be capable of yielding useful quantitative information on the analysis of elements in solution. The analysis of uranium in tributyl phosphate solution is described, and the analysis in aqueous solution of uranium, thorium, zirconium, molybdenum, niobium, strontium, iron, and yttrium. It is concluded that the method is capable of wide application. In the examples studied the performance of the technique compares favorably with chemical methods. Using a sensitive counter recording instrument considerable gain in speed of analysis would accrue. (auth)

5180 SCS-R-172

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

DETERMINATION OF CHROMIUM IN CALCIUM FLUORIDE MOULD LINING. G. Robertson. 1959. Date of MS. Mar. 13, 1951. 11p.

Chromium can be separated quantitatively from calcium fluoride, after decomposition with fusion mixture and potassium nitrate, by leaching with water. The final estimation is carried out colorimetrically using diphenylcarbazide. The effect of the reagents used, and of any impurities present, on the final color intensity is discussed. The state of oxidation of the chromium at different points in the procedure is considered. For oxidation of the chromium prior to color development methods are given using ammonium persulfate and potassium bromate. (auth)

5181 AEC-tr-3940

THE EXAMINATION OF MATERIALS BY MEANS OF DERIVATION THERMOGRAVIMETRY. L. Erdey. Translated for Los Alamos Scientific Lab. from Chem. zvesti 12, 352-65(1958). 13p. JCL or LC.

A complete survey of the methods of differential thermal analysis, thermogravimetry, and derivation thermogravimetry is given. The advantages of these methods are pointed out. The method of derivation thermogravimetry is useful in the determination of many ores, industrial raw materials, solid and liquid fuels, and analytical precipitates. The results enable the method to be used for theoretical research, as well as industrial purposes. With its help it was possible to determine a certain dependence of non-protonic acid base reactions in the sequence of strength of Lewis acids and bases. (auth)

5182 CEA-tr-A-593

TITRATIONS AMPÉROMÉTRIQUES AVEC COURANT ALTERNATIF. (Amperometric Titrations with Alternating Current). E. Juhasz. Translated into French by A. Ritter from Acta Chim. Acad. Sci. Hung. 9, 145-51 (1956). 13p.

An experimental apparatus is described which measures constant-intensity alternating current and thereby the polarization voltage in a solution by means of an electronic voltmeter. This apparatus was used to determine endpoints in a number of amperometric titrations. The sensitivity of the potential jump produced at the end-point depends on current density and frequency. Some titrations done by this method are Fe^{2+} by $KMnO_4$, $K_2Cr_2O_7$, and $Ce(SO_4)_2$ at a Pt electrode; Ce^{4+} by KNO_2, As_2O_3, and H_2O_2 at a Pt electrode; and Ag^+ by KI, KBr, KCl, KCNS, and KCN at an Ag electrode. (T.R.H.)

5183 CEA-tr-A-605

MÉTHODE D'UTILISATION DES ISOTOPES RADIOACTIFS EN ANALYSE CHIMIQUE. (Method for Use of Radioactive Isotopes in Analytical Chemistry). N. Getoff. Translated into French by B. Moreau from Atompraxis 3, 458-68 (1957). 49p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5303.

5184 CEA-tr-X-152

SÉPARATION ET DOSAGE DE FAIBLES QUANTITÉS DE BARYUM EN PRÉSENCE DE STRONTIUM ET DE CALCIUM. (Separation and Determination of Small Quantities of Barium in the Presence of Strontium and Calcium). A. Tockstein and V. Novak. Translated into French from Chem. listy 52, 269-75(1958). 19p.

The displacing power of Co^{2+} with respect to EDTA complexes of alkaline earth metals was used in a micromethod for quantitative separation of small quantities of Ba (< 1 mg) as sulfate in the presence of great excesses of Ca and Sr. The $BaSO_4$ was then polarographically determined. For a large number of determinations 81% had errors less than 3%, and in the remaining 19% the error was less than 4.5%. (T.R.H.)

5185 CEA-tr-X-155

EMPLOI DES COMPLÉNONES DANS L'ANALYSE CHEMIQUE. L.III. DOSAGE PHOTOMÉTRIQUE DU NIOBIUM ET DU TANTALE AU MOYEN DE LA PYROCATECHINE ET DE L'ACIDE ÉTHYLÈNE DIAMINETETROCÉTIQUE. (Use of Complexones in Chemical Analysis. LIII. Photometric Determination of Niobium and Tantalum by Means of Pyrocatechol and Ethylenediaminetetraacetic Acid). V. Patrovsky. Translated into French from Chem. listy 52, 255-61(1958). 17p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 13275.

5186 CEA-tr-X-158

DOSAGE SPECTROGRAPHIQUE DE L'URANIUM À L'AIDE DU 2-ACÉTOACÉTYL-PYRIDINE. (Spectrographic Determination of Uranium Using 2-Acetoacetylpyridine). T. Hara. Translated into French by S. S. Minn from Nippon Kagaku Zasshi 78, 333-7(1957). 5p.

The method consists in using 2-acetoacetylpyridine (AAP) as the analytical reagent. The uranyl–AAP complex salt is extracted into butyl acetate at pH 7.0 to 7.7, and the absorptivity of the solution is measured at 382.5 mμ. The sensitivity of this method is 2.6 times that of the method using dibenzoylmethane. (T.R.H.)

5187

DETERMINATION OF RADIOACTIVITY IN SALINE WATERS. Vincent J. Sodd, Abraham S. Goldin, and Richard J. Velten (Robert A. Taft Sanitary Engineering Center, Cincinnati). Anal. Chem. 32, 25-6(1960) Jan.

A screening method for the determination of gross radioactivity in saline waters is based on the precipitation of many cations as sulfides from ammoniacal solution. Carrier lanthanum, iron(III), cobalt(II), zinc, and nickel are precipitated while the major sea water salts are left in solution. An alkaline earth fraction containing strontium, barium, and radium can be recovered by precipitation of carbonates from the sulfide filtrate followed by precipitation of strontium carrier as nitrate. Cesium can be recovered separately by precipitation with silicotungstic acid and conventional purification. (auth)

5188

AN INDIRECT ABSORPTIOMETRIC METHOD FOR THE DETERMINATION OF BORON. Robert H. Campbell and M. G. Mellon (Purdue Univ., Lafayette, Ind.). Anal. Chem. 32, 50-54(1960) Jan.

A new indirect absorptiometric method for boron, based on the fluoride complexes of molybdate and boric acid has a molar absorptivity of 7000 and a determination range from 0.1 to 2.5 mg of boron per 50 ml. The method is subject to interferences from elements forming strong fluoride complexes or heteropoly acids. If the method is used with the methyl borate separation technique, all these interferences are eliminated. The variables affecting the method were investigated, and the optimum working conditions determined. (auth)

5189

DETERMINATION OF CADMIUM IN ZINC CONCENTRATES AND OTHER ZINC-RICH MATERIALS. A CATION PROCEDURE. Silve Kallmann, Hans Oberthin, and Robert Liu (Ledoux & Co., Teaneck, N. J.). Anal. Chem. 32, 58-60(1960) Jan.

The iodide medium is well suited for the separation of cadmium and zinc by ion exchange. While strongly basic anion exchange resin provides a clean-cut separation of the two elements, procedures based on the use of strongly acidic cation exchange resin were found to be far more rapid and convenient. A method is described which yields cadmium as the CdI_4^{-2} complex in the first eluate, while all other constituents are retained by the resin. A cadmium determination can be carried out in a complex zinc matrix in less than 4 hours. (auth)

5190

AUTOMATIC RECORDING VELOCITY-SERVO POTENTIOMETRIC TITRATOR. M. T. Kelley, D. J. Fisher, and E. B. Wagner (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 61-6(1960) Jan.

A versatile automatic, recording potentiometric titrator was designed with a "thinking" velocity servomechanism to control the rate of titrant addition automatically and proportionately so that near-equilibrium conditions are maintained throughout the titration. Although designed for the remote titration of highly radioactive materials, it is equally useful for macro- and microtitrations of nonradioactive samples. By appropriate choices of the size of the syringe and of the concentration of the titrant solution, wide ranges of sample size can be titrated. In macrotitrations of uranium (about 0.2 meq. titrated with 0.1N ferric sulfate) a relative standard deviation of 0.1% is obtained. In microtitrations of uranium or iron (about 2 μeq. titrated with ~0.04N ceric sulfate) the relative standard deviation is 1.0%. (auth)

5191

STANDARD TITANIUM–HYDROGEN SAMPLES. M. J. Trzeciak (Battelle Memorial Inst., Columbus, Ohio). Anal. Chem. 32, 72-4(1960) Jan.

A method is described for making individual titanium-hydrogen standards to be used in comparing results of analysis by a given laboratory with the amount of hydrogen added to the standard samples. A total of 67 standard samples were analyzed separately by five laboratories. There was agreement between the result of a given laboratory and the amount of hydrogen added to within 3% on 41 samples and to within 6% on 19 samples. Agreement on seven samples was outside these limits. (auth)

5192

THERMAL STABILITY AND TITRIMETRIC DETERMINATION OF DECABORANE. Mae I. Fauth and Clawell F. McNerney (U. S. Naval Propellant Plant, Indian Head, Md.). Anal. Chem. 32, 91-3(1960) Jan.

A method for the quantitative determination of decaborane consists of oxidation with potassium iodate, reaction of excess iodate with potassium iodide, and titration of the liberated iodine with sodium thiosulfate. Acetic acid was found to be the most satisfactory solvent for the decaborane. Recoveries on the order of 98% have been obtained. Differential thermal analysis curves are presented for decaborane heated in air and in helium for the temperature range 20° to 150°C. (auth)

5193

DETERMINATION OF NICKEL AND COBALT IN HIGH-ALLOY AND STAINLESS STEELS. L. L. Lewis and W. A. Straub (U. S. Steel Corp., Monroeville, Penna.). Anal. Chem. 32, 96-9(1960) Jan.

A method was developed for the routine determination of large amounts of nickel and cobalt in complex high-alloy and stainless steels. Nickel is isolated from other elements by dimethylglyoxime precipitation with or without a preliminary ion exchange separation, and cobalt is isolated by ion exchange. The separated metals are then determined by titration with (ethylenedinitrilo)tetraacetic acid. The method has the advantage of speed, yet retains the accuracy of the commonly used methods for determining these elements. (auth)

5194

APPLICATION OF EDTA TO TITRIMETRIC DETERMINATION OF NICKEL IN NONFERROUS ALLOYS. Vernon A. Nelson and Lewis J. Wrangell (Allis-Chalmers Mfg. Co., Milwaukee). Anal. Chem. 32, 99-103(1960) Jan.

A method is described for the titrimetric determination of nickel in nonferrous alloys, using EDTA. Separation and purification of nickel are accomplished by double precipitation with dimethylglyoxime, thus eliminating the use of hydrogen sulfide for the removal of copper. Interferences caused by cobalt, iron, and tin are avoided. Cal Ver I is the indicator chosen. The method has been applied to a wide variety of nonferrous alloy standards containing from 0.16 to 66.38% nickel. The 95% confidence limits for a single determination in the 0.16 to 0.60% range are ±0.03% in the 30.08 to 66.38% range they are ±0.21%. (auth)

5195

MULTIFUNCTION AUTOMATIC RECORDING PHOTOMETRIC TITRATOR. P. W. Mullen and Anthony Anton (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Anal. Chem. 32, 103-6(1960) Jan.

A versatile automatic recording photometric titrator, suitable for colorimetric, nephelometric, and chemiluminescent indicator titrimetry, was assembled from a Precision-Dow recording potentiometric titrator, a modified Beckman Model B spectrophotometer, and necessary intermediate electronic components. The operation of the titrator is described and typical titration curves are shown. (auth)

5196

AUTOMATIC RECORDING OF DISSOLVED OXYGEN IN AQUEOUS SYSTEMS CONTAINING SURFACE ACTIVE AGENTS. K. H. Mancy and D. A. Okun (Univ. of North Carolina, Chapel Hill). Anal. Chem. 32, 108-14(1960) Jan.

A polarographic method was developed which permits continuous sampling, recirculation, and automatic recording of dissolved oxygen in aeration processes. In this system the effect of various types of surface active agents on the electrode reaction kinetics was studied. Surface adsorption of the surface active agents on the dropping mercury electrode interferes with dissolved oxygen determinations in the potential region of the first oxygen wave in the case of anionic compounds; cationic compounds interfere at the second oxygen wave; and in the case of nonionic compounds, interference occurs throughout the entire range of applied voltage. With anionic compounds dissolved oxygen determinations were made at an applied voltage corresponding to the second oxygen wave. With cationic compounds, measurements were made at an applied voltage corresponding to the first oxygen wave. (auth)

5197

APPARATUS FOR PYROHYDROLYTIC DETERMINATION OF FLUORIDES. John G. Surak, Dale J. Fisher, C. L. Burros, and L. C. Bate (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 117-19(1960) Jan.

An efficient, inexpensive pyrohydrolysis apparatus is described for determination of fluorides in materials from which fluorides are difficult to separate by fluosilicic acid distillation. The reaction chamber is constructed of nickel. An unmodified, standard tube furnace functions as a superheater for the steam and as the heater for the reaction chamber. In the absence of interferences due to anions of volatile acids, the hydrofluoric acid evolved from about 30 mg of fluoride is determined by direct alkalimetric titration. Thoron may be used for colorimetric determination of the hydrofluoric acid evolved from samples containing microgram amounts of fluoride. For samples that contain about 30 mg of fluoride, the precision is within 1%. (auth)

5198

DETERMINATION OF NIOBIUM IN THE PARTS PER MILLION RANGE IN ROCKS. F. S. Grimaldi (Geological Survey, Washington, D. C.). Anal. Chem. 32, 119-21(1960) Jan.

A modified niobium thiocyanate spectrophotometric procedure relatively insensitive to titanium interference is presented. Elements such as tungsten, molybdenum, vanadium, and rhenium, which seriously interfere in the spectrophotometric determination of niobium, are separated by simple sodium hydroxide fusion and leach; iron and magnesium are used as carriers for the niobium. Tolerance limits are given for 28 elements in the spectrophotometric method. Specific application is made to the determination of niobium in the parts per million range in rocks. The granite G-1 contains 0.0022% niobium and the diabase W-1 0.00096% niobium. (auth)

5199

DETERMINATION OF SILICON BY DISTILLATION-COLORIMETRIC METHOD. Ben D. Holt (Argonne National Lab., Lemont, Ill.). Anal. Chem. 32, 124-8(1960) Jan.

A method is described for the separation of microgram quantities of silicon from plutonium and other metals for colorimetric determination. The silicon is volatilized as the tetrafluoride from a perchloric acid solution in an all-plutonium, uniformly heated still. The distillate is absorbed in a solution of boric and molybdic acids, in which the molybdenum blue color is developed. Most of the silicon distills over during the fourth and fifth minutes of the 10-minute heating period. Only 0.05 ml of reagent hydrofluoric acid (50%) is needed for the 0- to 50-γ range. Nitric acid is added with the hydrofluoric acid to ensure complete decomposition of elemental silicon. Results from the analyses of plutonium, uranium alloys, steels, and phosphoric acid by this technique are presented. (auth)

5200

DETERMINATION OF THE VALENCE STATES OF NEPTUNIUM IONS IN SOLUTION BY CONTROLLED POTENTIAL COULOMETRY. Robert W. Stromatt (General Electric Co., Richland, Wash.). Anal. Chem. 32, 134-5(1960) Jan.

Procedures are discussed for producing neptunium(V), (IV), and (III) from a standard solution of neptunium, which contained only neptunium(VI). A controlled potential coulometer was used in making the determinations. (B.O.G.)

5201

ANALYSIS OF LITHIUM METAL, HYDRIDE, AND HYDROXIDE FOR NICKEL, COPPER, SILICON, IRON, CHROMIUM, ALUMINUM, AND HYDROXIDE. H. A. Friedman (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 137 (1960) Jan.

Methods are discussed for determining impurities which may be found in lithium compounds for use in nuclear technology. (B.O.G.)

5202

DETERMINATION OF IMPURITIES IN HELIUM BY GAS CHROMATOGRAPHY. Arthur W. Mosen and George Buzzelli (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Anal. Chem. 32, 141-2(1960) Jan.

In the method described a liquid nitrogen-cooled charcoal trap is used to concentrate the impurities, and a Type 5A molecular sieve column is used for separating hydrogen, oxygen, nitrogen, methane, and carbon monoxide. Carbon dioxide is determined in a separate sample using silica gel. (D.E.B.)

5203

SEPARATIONS INVOLVING SULPHIDES. XI. SEPARATION OF ALUMINIUM OR URANIUM FROM SOME ELEMENTS FORMING THIOSALTS. I. K. Taimni and S. N. Tandon (Univ. of Allahabad, India). Anal. Chim. Acta 21, 502-04 (1959) Dec. (In English)

A 2 N sodium sulfide can be used to separate arsenic, antimony, tellurium, selenium, molybdenum, mercury, gold, platinum, or rhenium from aluminum or uranium. (auth)

5204

SEPARATION AND DETERMINATION OF TITANIUM IN STAINLESS STEELS. M. N. Nadkarni, G. G. Nair, and Ch. Venkateswarlu (Atomic Energy Establishment, Bombay). Anal. Chim. Acta 21, 511-14(1959) Dec. (In English)

Titanium is separated from titanium-bearing stainless steels by coprecipitation with zirconium as phosphate from 2 to 3 N acid solutions after removal of iron by ether extraction. It is spectrophotometrically determined by the hydrogen peroxide method in the presence of oxalic acid, with an accuracy better than ±0.02%. V, Fe, Cr, Ni, Al, Cu, Mo, W, Nb, and Ta do not interfere. (auth)

5205

RAPID DETERMINATION OF THORIUM IN ORES. III. DETERMINATION OF MICROGRAM AMOUNTS OF THORIUM IN ILMENITE SANDS. V. T. Athavale, K. P. Oke, and M. M. Tillu (Atomic Energy Establishment, Bombay). Anal. Chim. Acta 21, 528-31(1959) Dec. (In English)

Thorium was used as the colorimetric reagent and mercuric iodate as carrier for the determination of thoria in monazite and ilmenite sands. (auth)

5206

DETERMINATION OF GASES IN PLUTONIUM, URANIUM AND ZIRCONIUM BY VACUUM FUSION. R. E. Taylor (General Electric Co., Richland, Wash.). Anal. Chim. Acta 21, 549-55(1959) Dec. (In English)

A vacuum fusion system suitable for routine analysis of gases present in plutonium, uranium, and zirconium was built and acceptable results were obtained with the exception of the determination of nitrogen in zirconium. Hydrogen is evolved by heating the metal in a vacuum while all gases are released by fusing the sample at 1900°C in a metal bath contained in a graphite crucible. The gases evolved from each sample are collected in individual bulbs for later mass spectrometric analyses. Hydrogen values within 5% and oxygen values within 10% are obtained on zirconium standards. The results for plutonium samples analyzed by the iron and platinum bath techniques are in satisfactory agreement. The apparatus and techniques described provide a method whereby the gases present in 5 separate metallic samples may be collected in one melting operation of less than two hours duration. (auth)

5207

DETERMINATION OF FREE ACID IN URANIUM(VI) SOLUTIONS BY MEANS OF CATION EXCHANGERS. Z. I. Dizdar and I. D. Obrenović (Inst. of Nuclear Sciences "Boris Kidrich," Belgrade). Anal. Chim. Acta 21, 560-63 (1959) Dec. (In English)

An ion-exchange method for the determination of free acid in solutions containing uranium(VI) is described. The solution is passed through a cation exchanger in the hydrogen form and the total acidity is determined as well as the uranium content of the original solution. The free acid is then calculated. The method is also applicable to solutions containing other hydrolyzable cations. (auth)

5208

THE DETERMINATION OF TRACES OF RARE EARTHS IN ZIRCONIUM AND ITS ALLOYS. D. F. Wood and M. Turner (Imperial Chemical Industries Ltd., Kynoch Works, Birmingham, Eng.). Analyst 84, 725-31(1959) Dec.

A procedure is described for determining rare earths in zirconium and its alloys. It is based on solution of the sample in hydrofluoric acid, addition of yttrium and ytterbium, precipitation of yttrium and rare-earth fluorides, purification of the precipitate by chemical procedures and spectrographic evaluation of each individual rare earth in the final oxide residue. Yttrium is added as a carrier and is also used as an internal standard in the final stages of the procedure. Ytterbium is added as a "control" on the recovery of other rare earths. The limit of detection for each specified rare earth varies between 0.02 ppm for ytterbium and about 0.5 ppm for cerium. It is estimated that the lower limit of determination for the total rare earths is about 3 ppm. The time taken for a single determination, which includes all the rare earths, is 1½ to 2 days. (auth)

5209

COMPLEXOMETRIC TITRATION (CHELATOMETRY). XLIV. YTTRIUM DETERMINATION IN A MIXTURE OF YTTRIA. V. Patrovský (Zentralinstitut für Geologie, Prague). Collection Czechoslov. Chem. Communs. 24, 3305-8(1959) Oct. (In German)

The considerable difference between the atomic weight of Y and other elements of the Y group was used to determine Y in mixed yttria. From the titration equivalent determined by complexometric titration against xylenol orange and the weight of the starting mixture of oxide one can easily and precisely calculate the Y content. (tr-auth)

5210

ISOTOPE DILUTION MEASUREMENT OF CHYMOTRYPSINOGEN BIOSYNTHESIS BY MOUSE PANCREAS IN VITRO. Z. Berankova, I. Rychlík, and F. Šorm (Inst. of Chemistry, Czechoslovak Academy of Science, Prague). Collection Czechoslov. Chem. Communs. 24, 3476-82 (1959) Oct. (In English)

An isolation of chymotrypsinogen from mouse pancreas and the preparation of radioactive chymotrypsinogen-alanine C^{14} have been worked out. Isotope dilution was used to demonstrate the synthesis of chymotrypsinogen de novo by mouse pancreas in vitro and the rate of synthesis has been measured. (auth)

5211

QUANTITATIVE DETERMINATION OF YTTRIUM BY X RAY SPECTROSCOPY. Charles Legrand and Jean Loriers (Centre National de la Recherche Scientifique, [Paris]). Compt. rend. 249, 2565-7(1959) Dec. 9. (In French)

An x-ray spectroscopic method for Y in solutions is

offered. It is fast and avoids laborious chemical operations. For dilute solutions a Sr internal standard procedure is given; for higher concentrations a dilution technique is given. A relative precision of about 1% is obtained for Y proportions above 50%. The internal standard technique reaches this precision for lower concentrations. (T.R.H.)

5212

SPECTRAL METHOD OF DETERMINING THE ISOTOPIC COMPOSITION OF LEAD. PART II. A. N. Zajdel, A. G. Zhiglinski, and J. Čajko (State Univ., Leningrad). Czechoslov. J. Phys. 8, 665-84(1958). (In Russian)

Different methods of isotopic spectral analysis of lead are described. Analysis was carried out by measuring the intensities of the different components of hyperfine structure of the line PbI 4057.8 Å. Since the work was done under conditions for which self-absorption was practically eliminated, the so-called method without standards was used. The measurements showed, however, that under these conditions the method using standards gives greater accuracy. Apart from the method without standards we therefore paid attention to methods with standards and also to methods where the overlapping of the components of hfs are taken into consideration simultaneously with the use of a standard. By comparing the different methods of the isotopic spectral analysis of lead it is seen that the greatest accuracy is given by the method of one standard. The error in analysis in this case can be decreased to 1%. All these methods of analysis are elaborated for a region of 10–100% concentration of the measured isotope in the sample. (auth)

5213

MACRO- AND MICRODETERMINATION OF TRACE OF COBALT. III. SPECTROPHOTOMETRIC DETERMINATION USING NITROSO-SALT R SODIUM (NITROSO-1-NAPHTHOL-2-DISULFONATE-3,6). W. Haerdi, J. Vogel, D. Monnier, and P. E. Wenger (Universite, Geneva). Helv. Chim. Acta 42, 2334-42(1959). (In German)

A complete study was made of the determination of traces (up to 10^{-9} g) of Co by spectrophotometry using Nitroso-salt R. The errors were determined, and two new cuvettes are described. With the proposed technique 3×10^{-9}g of Co in a volume of 0.3 ml can be determined. (tr-auth)

5214

SPECTRAL-ISOTOPIC METHOD IN DETERMINING HYDROGEN IN STEEL. T. F. Ivanova, M. E. Trentovius, and V. V. Fedorov. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1120-3(1959) Sept. (In Russian)

A spectral-isotopic installation consisting of a DS-1 spectrometer, photoelectric recording block, and vacuum system was used for determining hydrogen in various types of steel. (R.V.J.)

5215

A SPEEDY SPECTRAL ANALYSIS OF METALLOMETRIC SPECIMENS OF RARE ALKALI, B, F, AND OTHER. P. A. Stepanov, E. A. Sergeev, M. V. Belobragina, and M. S. Leshchinskaya. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1149-50(1959) Sept. (In Russian)

An arc discharge method for the determination of B, Be, F, and Li in powdered specimens is described. Sensitivities for the method are $2 \times 10^{-4\%}$ for B and Be, $5 \times 10^{-4\%}$ for Li, and $5 \times 10^{-3\%}$ for F. (R.V.J.)

5216

SPECTRAL DETERMINATION OF URANIUM BY ISOTOPIC ADDITIONS. N. P. Ivanov (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1154-6(1959) Sept. (In Russian)

A development for improving the precision and universality of U isotope determinations is described. Known quantities of U^{233} and U^{238} are added to the specimen to be analyzed. Unknown concentrations are then determined by comparison with the knowns. The method does not consider background, and the order of precision is ±1 to 2%. (R.V.J.)

5217

SPECTROGRAPHIC DETERMINATION OF Sr AND Ca CONCENTRATION RATIO IN BIOLOGICAL OBJECTS. G. D. Litovchenko and S. A. Shipitsyn (Zhdanov Irkutsk Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1156-7(1959) Sept. (In Russian)

A new variation of spark excitation for powder samples, in which the upper part of the electrode is an aluminum or brass tube, was used in spectral analyses of the ratio of Sr and Ca in biochemical specimens. The absolute concentrations of Sr and Ca were determined using the 4215.52 and 4077.71A lines for Sr and the 4226.72A line for Ca. Concentrations and the ratio of the elements were estimated using plots of log (I/I_0) and log C. (R.V.J.)

5218

CORRELATION OF TGA AND DTA TEMPERATURES IN DECOMPOSITION REACTIONS. K. J. Notz and H. H. Jaffé (National Lead Co. of Ohio, Cincinnati). J. Am. Ceram. Soc. 43, 53-4(1960) Jan. 1.

Differential thermal analysis (DTA) and thermogravimetric analysis (TGA) were used in studies of the thermal decomposition of $UO_2(NO_3)_2$ and UO_3. Different reaction temperatures were indicated by DTA and TGA for each compound. It was concluded that decomposition in the customary DTA procedure occurs predominantly in an atmosphere of the decomposition gases. (C.J.G.)

5219

X-RAY DIFFRACTOMETRY WITH SLIGHTLY ABSORBING SAMPLES. H. A. Levy, P. A. Agron, and M. D. Danford (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 2012-13(1959) Dec.

A method for measuring x-ray diffraction intensities of samples which are deeply penetrated, such as liquid and nitreous materials, is described. The sensitive angle of the detector is limited by a scatter slit which is focused on exactly the same area of the sample surface as is illuminated by the primary beam. This scatter slit is placed between the receiving slit and the sample. The absorption correction for the arrangement is given. (C.J.G.)

5220

TRACE ANALYSIS OF MARINE ORGANISMS: A COMPARISON OF ACTIVATION ANALYSIS AND CONVENTIONAL METHODS. Rinnosuke Fukai and W. W. Meinke (Univ. of Michigan, Ann Arbor). Limnology and Oceanog. 4, 398-408 (1959) Oct.

A comprehensive review has been made of the abundance values reported for all trace elements in seaweed, mollusks, crustaceans, fishes, and in sea water. The sensitivities of standard spectrophotometric and flame photometric techniques for such analyses have been compared with the sensitivities expected from activation analysis techniques. Activation analysis eliminates the problem of contamination by reagents and is particularly useful for the analysis of minute traces. While it is not an all purpose method for every element, it does show promise of increasing the detection sensitivity for a number of elements by factors of 10, 100, or more as well as making possible

the discovery of elements not previously found in marine organisms, such as elements of the ruthenium of platinum groups and indium. (auth)

5221

ESTIMATION OF STRONTIUM IN BIOLOGICAL MATERIAL. Hana Holeyšovská-Kozáková (Ústav hygieny práce a chorob z povolání, Prague). Pracovní lékařství 11, 311-15(1959). (In Czech.)

Suitable conditions for the estimation of strontium on a Perkin-Elmer flame photometer were worked out. A method of isolating strontium from acidified urine by precipitating it as rhodizonate was developed. The precipitate was rinsed, dissolved in HCl, made up to 10 ml with water and the strontium was estimated on the flame photometer. Using this method, 4 ml urine were needed and the strontium was estimated within a range of 125 to 500 μg/1 ml urine, the final concentration of strontium in 1 ml of 10 ml specimen being 50 to 200 μg/1 ml. On an average 92 ± 8% of the strontium present was revealed using a Perkin-Elmer photometer and 94 ± 4% using a Zeiss photometer. A method for the removal of excessive amounts of phosphates by means of the anion exchanger Amberlite IR4B was developed. A method of complexometric titration with a metalochromium indicator for the estimation of strontium was also tested. This method is suitable for semiquantitative estimation of strontium, because it was not possible to completely separate strontium and calcium. (auth)

5222

HIGH PERFORMANCE MEASUREMENTS OF C^{14} AND H^3 RADIOACTIVITY IN ORGANIC COMPOUNDS. Vittoria Santoro (Centro di studio per la chimica nucleare, Padua). Ricerca sci. 29, 2420-6(1959) Nov. (In Italian)

A technique is described which is suitable to obtain a high performance determination of the specific activity of C^{14} and H^3 in organic compounds. Both the apparatus and the method present the advantage of a remarkable simplicity although they allow a high degree of accuracy. (auth)

5223

SPECTROPHOTOMETRIC DETERMINATION OF THORIUM WITH NEOTHORONE. Takeo Takahashi and Shingo Miyake (Univ. of Tokyo). Talanta 3, 155-9(1959) Dec.

In the spectrophotometric method for the determination of thorium with Neothorone (o-arsonophenylazochromotropic acid), the peak of the absorption spectrum of the thorium-Neothorone solution against a Neothorone blank solution lies between 570 mμ and 580 mμ. A suitable pH for the sample solution in the determination is 2, when the color of the thorium-Neothorone solution ceases to change about one hour after color development. Anions such as nitrate and citrate ions also interfere with the color reaction between thorium and Neothorone. (auth)

5224

A GAMMA ABSORPTIOMETER FOR LABORATORY ANALYSIS OF THE HEAVY ELEMENTS. W. L. Maddox and M. T. Kelley (Oak Ridge National Lab., Tenn.). Talanta 3, 172-6(1959) Dec.

Construction of a simple gamma absorptiometer employing a small Am-241 source for the determination of U or Pu in relatively pure solutions is described. The instrument yields a recorded voltage directly proportional to absorbance. (auth)

Radiation Chemistry

5225

A DETAILED STUDY OF THE SAMUEL-MAGEE MODEL FOR THE RADIATION CHEMISTRY OF WATER. PART II. KINETICS OF RADICAL REACTIONS IN THE TRACKS OF DENSELY IONIZING PARTICLES. P. J. Dyne and J. M. Kennedy (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. 38, 61-76(1960) Jan.

The kinetics of recombination of H and OH radicals, formed in liquid water along the track of a densely ionizing particle in the manner suggested by Samuel and Magee, were studied using an electronic computer. The variation in yields with track density is in good qualitative agreement with experiment. Arguments are advanced to show that the energy required to produce one effective radical pair in liquid water is about 20 ev. Discussions are presented on the effects of scavenger concentration and its depletion at the center of the track, track diameter, the value of the rate constant for the recombination of H atoms and OH radicals, and the value of $G(-H_2O)$ as a function of track density. (auth)

5226

THE RADIOLYSIS OF SOME ORGANIC HALOGEN COMPOUNDS IN AGUEOUS SOLUTION. R. J. Woods and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon). Can. J. Chem. 38, 77-93(1960) Jan.

Dilute aqueous solutions of some halogen-substituted ethanols, acetaldehydes, and acetates were irradiated with Co^{60} gamma rays, and the yield of acid products determined. Irradiations were carried out using air-saturated solutions and also solutions from which the air had been displaced by nitrogen or hydrogen. The acid yields are correlated with the structure of the organic compounds. (auth)

5227

ON LUMINESCENCE DECAY TIMES AND THEIR RELATION TO MECHANISMS OF ENERGY TRANSFER IN RADIATION CHEMISTRY OF LIQUIDS. Milton Burton and Herbert Dreeskamp (Univ. of Notre Dame, Ind.). Discussions Faraday Soc. No. 27, 64-73(1959).

Luminescence against time curves, obtained by a newly developed technique, are given. Decay times of luminescence processes in mixed cyclohexane + benzene scintillator systems (with air present) lie in the range around 2×10^{-9} sec. Addition of benzene to a cyclohexane solution of p-terphenyl causes a sharp rise in the decay time to a maximum at low benzene concentrations. The decay time is attributed tentatively to the energy transfer process from the lowest excited state. The estimated fraction of such low excited states transferring excitation to the scintillator is only 0.04 to 0.08. On the other hand, the scintillator appears also to quench the excited solvent. With the preliminary data at hand, the luminescence decay times are used as a tool for interpretation of the mechanism of protection in radiolysis of mixed liquid systems. (auth)

5228

RADIATION OXIDATION OF n-HEPTANE AND n-NONANE AS DEPENDENT ON TEMPERATURE. N. A. Bakh and T'i T'ien-chen (Inst. of Electrochemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 129, 604-6 (1959) Nov. 21. (In Russian)

The formation of liquid-phase oxidation products in n-heptane and n-nonane at −80 to 130°C, irradiated with doses of 1×10^{14} to 8×10^{15} ev/cm^3 sec, was studied in order to determine the dependence of oxidation on temperature and radiation intensity. (R.V.J.)

5229

AN INVESTIGATION OF GRAFT POLYMERIZATION WITH IRRADIATED TEFLON. Z. A. Sinitsyna, Yu. (Iu.) D. Tsvetkov, Kh. S. Bagdasaryan, and V. V. Voevodskiĭ (Inst.

of Chemical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 129, 631-4(1959) Nov. 21. (In Russian)

Data are presented on the kinetics of methyl methacrylate graft co-polymerization with irradiated teflon films. Results of electron paramagnetic resonance studies of the film are included. (R.V.J.)

5230

DETERMINATION OF IRRADIATION PRODUCTS BY MEANS OF PEROXIDATIVELY ACTING ENZYMES. H. Aebi, R. Gressly, R. Oestreicher, and A. Zuppinger (Universität, Bern). Helv. Chim. Acta 42, 2531-40(1959). (In German)

For the detection of H_2O_2 formed by x rays in aqueous solution two enzyme systems have been used: a) liver-catalase and C^{14} labeled formate, $C^{14}O_2$ being the reaction product; b) horseradish-peroxidase and o-dianisidine, the oxidation of which can be followed colorimetrically. Liver-catalase and horseradish-peroxidase are resistant enough to yield amounts of reaction products directly proportional to the x-ray dose up to 15,000 r. The influence of experimental conditions and of inhibitors on the enzymatic component in radiation induced formate oxidation has been investigated and is discussed in view of the biological role of catalase. (auth)

5231

POLYMERIZING VINYL-2-ETHYL HEXOATE WITH GAMMA-RAYS. D. A. Guthrie and J. F. Black (Esso Research and Engineering Co., Linden, N. J.). Ind. Eng. Chem. 52, 51-4(1960) Jan.

The polymerization of vinyl-2-ethyl hexoate was studied to determine the effects resulting from initiation of the reaction with ionizing radiation. The reaction rates were observed to be proportional to initial monomer concentration, independent of monomer conversion, and first-order with radiation intensity. Polymer molecular weight is linear with conversion. These kinetic results can be explained by assuming that polymerization is initiated by radicals formed from solvent and polymer molecules as well as from the monomer. From these results, it is possible to calculate the relative efficiency with which the radicals derived by irradiation of various solvents can initiate polymerization. The results also provide direct evidence of the importance of grafting in radiation-initiated polymerization. (auth)

5232

REACTIONS INITIATED BY β DECAY OF TRITIUM. II. THE TRITIUM–ETHYLENE SYSTEM. Kang Yang and Preston L. Gant (Continental Oil Co., Ponca City, Okla.). J. Chem. Phys. 31, 1589-94(1959) Dec.

Because of the β decay of tritium gas, $T_2 \rightarrow (He^3T)^+ + e$, the tritium-ethylene system undergoes reactions yielding various tritiated hydrocarbons. From the effects of three experimental variables (T_2 conc., γ irradiation, replacing T_2 by HT) on the rates of formation of tritiated compounds, two types of labeling processes were distinguished: recoil labeling; $(He^3T)^+ + C_2H_4 + (e) \rightarrow$ Tritiated compounds, and β labeling; $T_2 + C_2H_4 \overset{c}{\leftrightarrow}$ Tritiated compounds. Formation of tritiated ethylene involved both processes; its rate was independent of temperature (25°C $\leftrightarrow$ −78.5°C), and not affected by the addition of nitric oxide ($[NO]/[C_2H_4] \simeq 0.05$). Tritiated ethane, propane, and n-butane were formed exclusively by the β-labeling process; the rate of formation of these compounds increased with decreasing temperature and nitric oxide almost completely eliminated their production. Probable mechanisms for the recoil and β-labeling processes are discussed. (auth)

5233

SOME ASPECTS OF THE RADIATION CHEMISTRY OF LIQUID ALIPHATIC CARBOXYLIC ACIDS. Russell H. Johnsen (Florida State Univ., Tallahassee). J. Phys. Chem. 63, 2041-3(1959) Dec.

The decomposition of ten aliphatic carboxylic acids by γ-radiation was studied with particular reference to their relative rates of decarboxylation. The effects of structural variation, added iodine, and temperature were investigated as well as the distribution of free radicals for one of the acids as determined by radio-iodine trapping techniques. It is suggested that the mechanism of decarboxylation involves the intermediate formation of free alkyl and carboxyl radicals. (auth)

5234

PHOTOLYSIS OF GAMMA-RAY PRODUCED FREE RADICALS IN ETHANOL AT LOW TEMPERATURES. Russell H. Johnsen (Florida State Univ., Tallahassee). J. Phys. Chem. 63, 2088-9(1959) Dec.

The consequences of bleaching γ-irradiated ethanol gases with visible and ultraviolet light were studied. Analyses of the gaseous products of degassed ethanol (both anhydrous and benzene-free) were made by a modification of the Sanders-Taylor method combined with vapor-phase chromatography for the less volatile fraction. An increase in the amount of gaseous decomposition products were observed when ultraviolet light was used, indicating that the yield-determining factor seems to be the extent to which the paramagnetic species are decomposed. It is proposed that the increased yields are due to the photolysis of the ethanol free radical which under ordinary conditions would either dimerize or recombine with a hydrogen atom. (C.J.G.)

5235

FORMATION OF INTERSTITIALS IN ALKALI HALIDES BY IONIZING RADIATION. R. E. Howard and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 116, 314-15(1959) Oct. 15.

Recent experimental evidence seems to indicate that interstitials in alkali halides are formed by ionizing radiation. The validity of the so-called Varley mechanism depends on several factors such as the lifetime of the positive halogen ion, lattice geometry, etc. These are evaluated and found favorable. (auth)

5236

CHEMICAL EFFECTS OF RADIOACTIVE BROMINE ATOMS PRODUCED BY BROMINE REACTION WITH NEUTRONS IN CH_2ClBr, $CHCl_2Br$, and $CHClBr_2$. An. N. Nesmeyanov and E. A. Borisov. Radiokhimiya 1, 86-90 (1959). (In Russian)

The behavior of recoil atoms of bromine was studied in neutron-bombarded chlorobromomethanes. Various concentrations of bromine and bromine allyl were added to CH_2ClBr, $CHCl_2Br$, and $CHClBr_2$ before irradiation. (R.V.J.)

5237

EFFECTS OF GAMMA RADIATION ON PHYSICO–CHEMICAL PROPERTIES OF SOME CATIONS. A. M. Semushin and I. A. Kuzin (Leningrad Technological Inst.). Zhur. Priklad. Khim. 32, 2193-7(1959) Oct. (In Russian)

Data are presented on the stability of cations when irradiated by $Co^{60}\gamma$ quanta. Studies of several types of carboxyl resins revealed that methacrylic acid base cations KB–2P–2 and KMT are less stable than the KFU resins prepared by the polycondensate reaction of phenoxyacetic acid with formaldehyde. Radiation induced polymer chain destruction appears as swelling in water

or alkali. The content of divinyl-benzene in the KU-2 resin influences its solubility, but at given radiation doses it does not influence the capacity per gram. (R.V.J.)

Radiochemistry

5238 CEA-tr-X-151

ETUDES CHIMIQUES SUR LES INDICATEURS RADIOACTIFS. (Chemical Study of Radioactive Indicators. Separation of Yttrium from a Mixture of Strontium and Yttrium in the Radioactive Equilibrium State). [M]. Ishibashi, [T.] Fujinaga, and [Nobufusa] Saito. Translated into French by San Sik Minn from Nippon Kagaku Zasshi 79, 978(1958). 11p.

A study was made of the conditions in which Y^{90} remains quantitatively in the internal compartment of a Hildebrand double-cylinder cell with a Hg cathode. The Y^{90} used was purified by the radiocolloidal method. The same electrolytic method was then used to separate carrier-free Y^{90} from Sr^{90} in radioactive equilibrium. The effect of SrCl, when used as carrier, was investigated. (tr-auth)

5239

GAS-PROPORTIONAL COUNTING OF CARBON-14 AND TRITIUM AND THE DRY COMBUSTION OF ORGANIC COMPOUNDS. David R. Christman and Catherine M. Paul (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 32, 131-2(1960) Jan.

An anticoincidence counter, operating with a ring of proportional counters and with two proportional sample counting channels, was used for carbon-14 and tritium gas-proportional counting. Both the precision and the lower limit of activity detection were significantly improved. This method allows detection with a certainty of 1 cpm, whereas 2 cpm was previously considered the lower detection limit. A problem in the dry combustion of volatile organic liquids was resolved. (B.O.G.)

5240

CO-PRECIPITATION OF RADIO ELEMENTS FORMING SOLID SOLUTIONS WITH LIMITED MISCIBILITY. I. V. Melikhov, M. S. Merkulova, and G. Eval'd. Radiokhimiya 1, 1-10(1959). (In Russian)

The relationship of microcomponent concentration of admixture in a system was studied with $NaCl-PbCl_2-H_2O$ and $NaCl-CdCl_2-H_2O$ systems in order to determine the regularities in co-precipitation of radioelements with crystals of non-isomorphous salts formed from saturated solutions. The experiments used recrystallized sodium chloride salts and ThB(Pb^{212}), RaD(Pb^{210}), and Cd^{115} as microcomponents. (R.V.J.)

5241

CO-CRYSTALLIZATION OF SMALL QUANTITIES OF SUBSTANCE WITH CRYSTALLINE PRECIPITATES. V. I. Grebenshchikova, R. V. Bryzgalova, N. B. Chernyavskaya, and V. N. Bobrova. Radiokhimiya 1, 11-21(1959). (In Russian)

Co-crystallization of a microcomponent assumes a maximum magnitude in co-precipitation of radioelements with complex or binary salts, forming anomalous mixed crystals, when the macrocomponent in the precipitate and the microcomponent in the solution have an identical stoichiometric formula, regardless of the magnitudes of the ionic charge. The studies employ three groups of elements. Lanthanum oxalate and binary sulfates of lanthanum were used as carriers (the macrocomponents) and trivalent Am^{241}, Eu^{154}, and Y^{91} were used as microcomponents. In one group the valence of the microcomponents was the same and in another differed from the carrier valence though their chemical properties were almost identical. In a third group the potassium salt K_2SO_4 was the macrocomponent while trivalent Y^{91}, Ce^{141}, La^{140}, and Am^{241} acted as microcomponents. The experiments proved the feasibility of using isomorphous crystallization for determining the boundaries of formation of complex ions and instability constants of radioelements in solutions. (R.V.J.)

5242

CHEMICAL REACTION OF RADIOACTIVE BROMINE ATOMS IN BROMINE REACTION WITH NEUTRONS IN HALOID REPLACED METHANE. An. A. Nesmeyanov, E. A. Borisov, and I. Zvara. Radiokhimiya 1, 325-35 (1959). (In Russian)

The localization of bromine recoil atoms after (n,γ) reaction with $CHBr_3$ was studied in relation to the concentration of bromine and allyl bromide added before the irradiation. It is shown that in diffusion processes, recoil atoms form only parental compounds. A scheme is presented for stabilizing recoil atoms in thermal reactions. It is postulated that the stabilization of bromine recoil atoms follows the inelastic collision mechanism. A different Br^{80m} and Br^{82} localization was found in CCl_3Br and CCl_2Br_2 irradiation. (R.V.J.)

5243

ON THE MOLECULAR STATE OF ULTRA-SMALL QUANTITIES OF RADIOELEMENTS IN SOLUTIONS. I. E. Starik, N. I. Ampelogova, F. L. Ginzburg, M. S. Lambet, I. A. Skul'skiĭ, and V. N. Shchebetkovskiĭ. Radiokhimiya 1, 370-8(1959). (In Russian)

Investigations of zirconium, polonium, americium, and promethium adsorption from aqueous solutions by non-exchangeable ion hydrophobic adsorbents indicate that the adsorption behavior of the radioelements is determined by their molecular state in the solution. The "salting out" observed in zirconium adsorption by Fluoroplast-4 with neutral salts depends not only on the anion concentration but also on the nature of the cation. The observed increase in zirconium adsorption by Fluoroplast in 0.2N HNO_3 and salts results from neutral complexes of zirconium formed in the solution. The identical behavior of polonium in TBP extraction and in adsorption by Fluoroplast-4 indicates a similarity of the processes, though different molecular complexes are formed. (R.V.J.)

5244

MICROQUANTITIES OF RADIOELEMENTS IN SOLUTIONS. IX. ON THE STATE OF MICROQUANTITIES OF ZIRCONIUM IN HYDROLYSIS. I. E. Starik and I. A. Skul'skiĭ. Radiokhimiya 1, 379-83(1959). (In Russian)

Experimental and theoretical data are presented on zirconium ion complexing OH^- groups, and various forms of microquantities of zirconium in aqueous solutions are tabulated. (R.V.J.)

5245

STATE OF MICROQUANTITIES OF RADIOELEMENTS IN SOLUTIONS. X. STATE OF PROTACTINIUM IN AQUEOUS SOLUTIONS. I. E. Starik, L. D. Sheidina and L. I. Il'menkova. Radiokhimiya 1, 391-4(1959). (In Russian)

With solution pH 1 to 3, protactinium appears as an ion dispersion. Ions of $Pa(OH)^{4+}$ and $Pa(OH)_2^{3+}$ are formed by hydrolysis with pH > 3, while with further increase of pH the hydrolysis is even more complete; colloidal particles appear with pH > 5. (R.V.J.)

5246

SOLUBILITY AND ION EXCHANGE METHODS FOR DETERMINING THE COMPLEX FORMATION OF PLUTO-

NIUM AND AMERICIUM III IN AQUEOUS SOLUTIONS. A. I. Moskin. Radiokhimiya 1, 430-4(1959). (In Russian)

The formation of Pu(IV) complexes in phosphoric acid solutions and the dissociation constants of Pu(IV) phosphate complexes were studied by solubility methods. The Me: addend ratio of various Pu(IV) phosphate complexes and complexes of other investigated systems tends to shift, with the increase of complex forming agent concentration, toward the side of complexes with larger coordination numbers. The method of ion exchange was used in studies of tri- and pentavalent plutonium complex formation in oxalate and ethylenediaminetetraacetate solutions. Also, the distribution of small quantities of plutonium and americium between the solutions and KU-2 ammonium resin was studied with and without a complex forming agent in the pH range 1 to 5 at 20 ± 1°C. The content of plutonium and americium(III) was determined radiometrically. The pK magnitudes for examined complexes were calculated using the pK equation calculated for trivalent transuranium elements, and $pK = 0.0645 \times A^{1.24}$. The pK's for Np(III) and Bk(III) EDTA complexes were also estimated. The similarity of trivalent plutonium and americium behavior was observed as well as the behavior of tetra, penta-, and hexavalent plutonium with other actinides of identical valence. (R.V.J.)

Separation Processes

5247 AERE-CE/R-2777

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CYCLONES AS LIQUID-LIQUID CONTACTOR-SEPARATORS. J. W. Hitchon. Sept. 1959. 30p. BIS.

The use of cyclones for contacting and separating two immiscible liquids was investigated using a system 0.25M aqueous nitric acid/20% by volume tri-butyl phosphate in odorless kerosene/uranyl nitrate, for which accurate equilibrium data were available. Good separation of the two liquids was achieved by use of a system of two cyclones and a recycle circuit, and mass transfer efficiency was good. The possibility of using such a system as a stage in a multistage countercurrent solvent extraction apparatus is considered. Such a system would have a high processing rate/unit volume or low residence time, a characteristic which would be favorable for the treatment of enriched fissile-material solutions or highly active solutions. (auth)

5248 CF-59-12-45

Oak Ridge National Lab., Tenn.

DESCRIPTION OF A PROPOSED PROGRAM: DYNAMIC ANALYSIS OF RADIOCHEMICAL PLANT COMPONENTS. M. E. Whatley. Dec. 15, 1959. 8p. Contract [W-7405-eng-26]. OTS.

The mathematical models which are now available to describe the separation operations being used in the radiochemical separations plants are inadequate either for use in computer controlled plants or for adequate understanding of the fundamentals of their operation. A study is proposed to analyze the solvent extraction operation in order to produce a method of calculating steady state contactor performance for optimizing new flow sheets, and to describe the transient effects in the operation in order to better understand the limitations of the steady state model, to establish quantitative criteria for control, and to provide models for future application to computer controlled plants. (auth)

5249 CRCE-790

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE DEVELOPMENT OF A LARGE SCALE AIR LIFT CONTACTOR. W. G. Mathers, L. C. Cornett, and E. E. Winter. Sept. 1959. 50p. (AECL-913). AECL.

A three-stage air lift contactor with a capacity suitable for the processing of 100 tons of uranium per year was designed, built, and tested. A method of interface control in a multistage contactor was tested, and measurements of the air required for proper physical operation under various conditions and of aqueous entrainment in the solvent phase were made. Estimates of required settler volumes and solvent overflow Weir widths are included. (J.R.D.)

5250 CRDC-674

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE PROCESSING OF IRRADIATED THORIUM FUELS USING TRIBUTYL PHOSPHATE-DECALIN. PART I. PARTITION DATA AND CALCULATIONS. W. W. Morgan. Dec. 1955. 30p. (AECL-508). AECL.

Partition data for Th, U, and HNO_3 between aqueous solution and 50% TBP-decalin (v/v) were obtained. McCabe-Thiele calculations were made which show that Th and U can be separated and purified by extracting into 50% TBP-decalin and partitioning with 0.25 M HNO_3. By utilizing decalin as the TBP diluent greater operating leeway results because the three phase problem no longer exists. (auth)

5251 HW-59193(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CONCENTRATION AND FINAL PURIFICATION OF NEPTUNIUM BY ANION EXCHANGE. J. L. Ryan. Feb. 10, 1959. Revised Sept. 3, 1959. 18p. Contract AT(45-1)-1350. OTS.

It was demonstrated that neptunium(IV) can be readily absorbed onto anion exchange resins from 6 M HNO_3 containing ferrous sulfamate and hydrazine or semicarbazide, separated from plutonium, uranium, and common metallic impurities by washing the resin at 25°C with 6 M HNO_3 containing ferrous sulfamate and hydrazine or semicarbazide, separated from fission products and thorium by washing the resin at 60°C with 8 M HNO_3–0.01 M HF containing hydrazine or semicarbazide, and eluted at concentrations greater than 40 g Np/l with 0.35 M HNO_3 at 25°C. Decontamination factors of greater than 10,000 from uranium, plutonium, and common metallic contaminants, greater than 25,000 for fission products normally expected in the feed (mainly Zr-Nb with some Ru-Rh), and greater than 1000 for thorium are obtainable under proper operating conditions. Because of the low processing rates, the necessity for carrying out the absorption cycle at 25°C and the absence of radiation damage problems, Dowex 1, X-4 (50–100 mesh) or Dowex 21K (50–100 mesh) resins are considered the best choices for this application. Gassing occurs with the use of ferrous sulfamate–semicarbazide reductant but is not a serious problem and does not occur with ferrous sulfamate–hydrazine reductant in 6 M HNO_3. (auth)

5252 HW-59709

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ANNULAR FIXED-BED ION-EXCHANGE STUDIES. G. A. Nicholson. May 12, 1959. 29p. Contract W-31-109-Eng-52. OTS.

The effect of gas formation in the bed on the operating

and mass transfer characteristics of both a simple and an annular fixed-bed ion-exchange column was studied. Standard methods were used in correlating the pressure drop and fluidization data. Other methods were used in studying the fluid channeling and/or resin loading characteristics of the simple and annular columns, respectively. (auth)

5253 HW-61106

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRELIMINARY CHEMICAL FLOWSHEETS FOR THE DECLADDING AND DISSOLUTION OF NON-PRODUCTION FUELS. M. K. Harmon. July 24, 1959. 9p. OTS.

Preliminary chemical flowsheets are presented for cladding and core dissolution of Zircaloy-clad UO_2 and stainless steel-clad U–Mo non-production fuels. (W.L.H.)

5254 HW-61482

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RATES OF REACTION OF IRRADIATED UO_2 AND URANIUM METAL WITH SULFURIC ACID. J. L. Swanson. Aug. 13, 1959. 8p. Contract AT(45-1)-1350. OTS.

The rates at which samples of irradiated UO_2 and U dissolve in H_2SO_4 were determined. Parallel experiments were performed with similar unirradiated samples. Data and observations on the dissolutions under various conditions are included. (J.R.D.)

5255 HW-61510

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLANT MODIFICATIONS FOR REPROCESSING NON-PRODUCTION REACTOR FUELS. DESIGN CRITERIA FOR FUEL ELEMENT STORAGE FACILITY, BUILDING 221-U. Project CGC-830. M. E. Yates. Aug. 17, 1959. 16p. Contract [AT(45-1)-1350]. OTS.

The design of facilities is reported for removing fuel elements from the casks and moving the elements to modified existing 10 ft by 16 ft by 14 ft storage tanks where they will be stored until scheduled for processing. Each storage tank is equipped with a storage rack for storing elements as received in a sub-critical array, two air-lift circulators for agitation to improve heat transfer and tank cleaning, and jumpers. Additional facilities are provided in one cell only for measuring the volume and inlet and outlet temperatures of the cooling water for technical information. All handling of the elements in their respective baskets will be accomplished by use of the existing 75-ton overhead remote crane. Provisions are also provided for the major decontamination of the casks in the railroad tunnel prior to their removal. (W.L.H.)

5256 HW-62490

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

HIGH-SPEED SAW TESTS. POWER REACTOR FUELS REPROCESSING DEVELOPMENT. V. P. Kelly. Nov. 18, 1959. 15p. Contract AT-(45-1)-1350. OTS.

The basic scheme for processing power reactor fuels at Hanford includes the removal of inert end fittings from the active sections of the fuels. High-speed saw blades, including abrasive, diamond, and friction blades, were tested under conditions similar to those encountered in the power fuels reprocessing program. In these tests, the greater durability of the steel friction blade established its superiority over the other two types. The greater durability was demonstrated in both cutting ability and tolerance for abuse. In addition to its primary use for the removal of end fittings and hardware from the power reactor fuels, some studies were made to determine whether high speed saws could be used for cutting of the main fuel cores into small segments for charging into the dissolver. The results of these experiments are also presented. (W.L.H.)

5257 IDO-14468

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A GELATIN-FILTRATION HEADEND FOR FUEL REPROCESSING SOLUTIONS FROM SILICON-CONTAINING ALUMINUM ALLOYS. Bill J. Newby and Bernice E. Paige. Feb. 6, 1959. 54p. Contract AT(10-1)-205. OTS.

A laboratory study of a gelatin headend process for feed from silicon-containing aluminum fuels and plant salvage solutions is described. The optimum conditions for the gelatin treatment of fuel solutions were to boil a 0.1 to 0.5N nitric acid solution with 100 milligrams of gelatin per liter for 30 minutes. This treatment improved filtration rates and decreased the surface activity of the filtrate for TBP extraction. A number of possible flowsheets for fuel solutions are presented using gelatin treatment and filtration. An adequate treatment was not found for salvage solutions of unknown composition because a gelatin dosage which was satisfactory for all solutions could not be selected. The optimum treatment for a salvage solution which was grossly contaminated with zirconium, soluble and colloidal silica, and dibutyl phosphate was to boil a 1N acid deficient solution with 600 milligrams of gelatin per liter, filter, and use a Hexone extraction system. A silicic colloid in fuel processing solutions was characterized as a surface active material by this study. (auth)

5258 IDO-14487

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ZIRCONIUM EXTRACTION BY TRIBUTYL PHOSPHATE. R. L. Hickok and R. D. Cannon. Nov. 9, 1959. 47p. Contract AT(10-1)-205. OTS.

A study was made of zirconium extraction by tributyl phosphate from solutions of nitric acid, mixed nitric and hydrofluoric acids, and acidic solutions containing non-extractable salts of nitric and hydrofluoric acids. The effect of fluoride on the extraction was found to be beneficial at fluoride-to-zirconium mole ratios up to 1 to 1, but was severely inhibitory at higher fluoride-to-zirconium ratios. The extraction of a mixed zirconium complex containing one fluoride and three nitrate ions per zirconium atom was observed. Tributyl phosphate appears to be a useful extractant for zirconium for process applications if fluoride is not present, is present in concentrations no greater than the zirconium concentration, or if another metal such as calcium is present to complex or precipitate fluoride. (auth)

5259 IDO-14498

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ECONOMICALLY OPTIMUM SWEEPDOWN CRITERION FOR CHEMICAL PROCESSING. F. H. Tingey. Nov. 30, 1959. 21p. Contract AT(10-1)-205. OTS.

Construction of periodic material balances is fundamental to chemical processing. In the light of such balances the processor must decide whether to continue processing or sweep down the plant. Certain economic risks are associated with either course of action. Economically optimum sweepdown criterion is derived which minimizes the maximum risk, maximized with respect to the unknown true imbalance, and minimizes the expected maximum risk utilizing *a priori* information as to the likelihood of a real imbalance. (auth)

5260 MCW-1440

Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.

THE EFFECT OF URANIUM SATURATION ON THE EX-

TRACTION OF ELEMENTS OTHER THAN URANIUM INTO TRIBUTYL PHOSPHATE. G. P. Lang and J. T. Krieg. Jan. 4, 1960. 19p. Contract W-14-108-Eng-8. OTS.

In the tributyl phosphate extraction process for the purification of uranium, the separation from contaminating elements can be improved by the saturation of the extract to as high a degree as possible with uranium. This technique is examined first on the basis of the theoretical extraction equations. Then laboratory experimental data, consisting of equilibrium distribution values for nitric acid, thorium, europium, and zirconium nitrates into TBP-hexane, in the presence of increasing amounts of uranyl nitrate, are presented. These results indicate that decontamination can be markedly increased under conditions of high uranium saturation. These data are applied to the calculation of profiles for these elements in multistage countercurrent extraction and scrub units. The results are compared with the actual performance of the extraction section of an operating uranium refinery. (auth)

5261 ORNL-2844

Oak Ridge National Lab., Tenn.

THOREX PILOT PLANT CORROSION STUDIES: II. CORROSION OF TYPES 304L, 309SCb, AND 347 STAINLESS STEEL DURING DEVELOPMENT AND PRODUCTION-DEVELOPMENT PERIODS. J. L. English. Jan. 20, 1960. 50p. Contract W-7405-eng-26. OTS.

Corrosion data for types 304L, 309SCb, and 347 stainless steel were obtained in a number of process vessels in the ORNL Thorex pilot plant during the development and the production-development periods of operation occurring between December 1954 and September 1956. Stressed corrosion-test specimens were exposed in the batch dissolver tank, the feed adjustment tank, the BT vapor separator, the A-column feed tank, and the BTC catch tank. Generally, types 304L and 309SCb stainless steel exhibited comparable corrosion resistance in all environments examined. Most of the studies were conducted with these two alloys. Severe corrosion damage was encountered in the vapor phase of both the batch dissolver tank, operated at a maximum temperature of 115°C, and the feed adjustment tank, operated at a maximum temperature of 155°C. Corrosion rates for types 304L and 309SCb stainless steel varied from approximately 30 to 55 mpy in the batch dissolver tank during the development and the production-development periods. Vapor-phase corrosion rates in the feed adjustment tank during the last half of the development period ranged from 85 to 100 mpy. Severe corrosion attack was experienced also in the BT vapor separator, which operated at a maximum temperature of 115°C. Rates were 30 to 55 mpy for type 304L stainless steel, 25 mpy for type 309SCb stainless steel, and a maximum rate of 150 mpy for a composite specimen of types 309SCb and 347 stainless steel. Solution-phase corrosion rates for types 304L and 309SCb stainless steel in the batch dissolver tank ranged from 13 to 28 mpy, with the lower rates observed on the type 309SCb steel. The latter corroded at an average rate of 41 mpy in the feed adjustment tank, however. No data were available for type 304L stainless steel in the solution phase of this vessel. The corrosion of types 304L and 347 stainless steel was negligible in the A-column feed tank and the BTC catch tank; observed rates were less than 0.1 mpy. (auth)

5262 TID-3529(1st Rev.)

Technical Information Service Extension, AEC.

REPROCESSING OF IRRADIATED FISSION REACTOR FUEL AND BREEDING MATERIAL. A Literature Search. James M. Jacobs, comp. Jan. 1960. 41p. OTS.

A listing is presented of selected unclassified reports received by Technical Information Service Extension since TID-3312, Reprocessing of Irradiated Fission Reactor Fuel and Breeding Materials, was prepared. The listing contains 363 references. (J.R.D.)

5263

SOME QUANTITATIVE REMARKS ON EXTRACTION EQUILIBRIA. III. M. Oosting (Analytical Research Inst., T.N.O., Rijswijk, Netherlands). Anal. Chim. Acta 21, 505-10(1959) Dec. (In English)

The solubility products of Al, Cu, Fe Ni, Th, and U chelates are determined. The conditions for separation of Cu/UO_2, Fe/UO_2, and Fe/Al by extraction are calculated and shown to be correct. The separation of Al/UO_2 and UO_2/Th by extraction with oxine-chloroform was proved impossible under any conditions. (auth)

5264

THE SEPARATION OF SUBSTANCES WITH VERY SIMILAR PROPERTIES BY DISPLACEMENT METHODS USING ION EXCHANGERS. I. GENERAL STUDY. II. THE METHOD OF DEVELOPMENT BY DISPLACEMENT. Bernard Tremillon (Ecole de Physique et de Chimie, Paris). Bull. soc. chim. France, 502-11(1958). (In French)

From the theory it is possible to foresee a bilogarithmic symmetrical form for displacement isochrones, both in frontal analysis and in development by displacement. The claculation is justified by experiment, but it is impossible to foresee exactly the spread of these isochrones since the height equivalent theoretical plate varies considerably not only with the mechanical operating conditions of the columns but also with the kinetics of the exchange reaction, and therefore with the nature of the ions exchanged. It seems to be possible nevertheless to maintain it reasonably within limits lower than a few millimeters. This is one of the great advantages of the ion exchange chromatography method over most of the other methods of countercurrent separation. The closer the exchange constant is to unity, the greater is the spread of the isochrone. Any quantitative forecast on the subject is submitted to a preliminary experimental determination of the height equivalent theoretical plate. In any case it can be affirmed that very quantitative exchange reactions are not necessary in order to obtain exceedingly sharp separations. (auth)

5265

EXTRACTION OF SOME AMINO-SULFATES AND AMINO-BISULFATES. Christiane Boirie (Centre d'Études Nucléaires, Saclay, France). Bull. soc. chim. France, 980-85(1958). (In French)

Study was continued on the extraction of sulfuric acid by various amines, using different solvents. The composition of the compounds determined, and the equilibrium constants, and the effect of various factors were studied. Tri-n-octylamine was used for this work and we have verified the conclusions obtained when using a certain number of other amines. (auth)

5266

FLUORESCENCE OF CRYSTALLINE SUBSTANCES AND SOLUTIONS EXCITED BY X RAYS: APPLICATION TO ANALYSIS. M. Graulier. Bull. soc. chim. France No. 10, 1715-21(1959) Oct. (In French)

The laws for the absorption and emission of x rays by matter are briefly reviewed, and the apparatus and techniques used in analysis by x-ray-induced fluorescence are described. A very detailed classification of the perfected analysis is given. The precision, sensitivity, and rapidity

of this technique are compared with chemical, spectrographic, or polarographic methods. (tr-auth)

5267

EXTRACTION AND SEPARATION OF ZIRCONIUM AND HAFNIUM BY MEANS OF LIQUID ANIONIC EXCHANGERS IN A HYDROCHLORIC ACID MEDIUM. II. EXTRACTION WITH TRI-N-OCTYLAMINE. E. Cerrai and C. Testa (Centro Informazioni Studi Esperienze, Milan). Energia nuclear (Milan) 6, 768-80(1959) Dec. (In English)

The extraction behavior of tri-n-octylamine (TNOA) has been investigated for zirconium and hafnium. The separation factors have also been determined in many operating conditions. The effects have been investigated of: hydrochloric acid molarity, type of amine diluent, Zr and Hf concentration, amine concentration and amount, contact time, temperature, chloride ion concentration, addition of some acid as H_2SO_4, $HClO_4$, CH_3COOH, and HNO_3. A separation experiment was made in which a mixture of 97.8% Zr and 2.2% Hf (W/W) was extracted with 0.2 M TNOA-cyclohexane in 8 M HCl + 0.7 M HNO_3. With a single contact the hafnium content was brought down to 0.12% with a zirconium yield of 75%. (auth)

5268

NITRIC ACID, WATER AND TRIBUTYLPHOSPHATE EQUILIBRIUM SYSTEM. L. Damiani and V. Fattore (SICEDISON, Porto Marghera, Italy). Energia nucleare (Milan) 6, 793-8(1959) Dec. (In English)

An investigation was made of the HNO_3 and H_2O extraction mechanism using TBP. From stoichiometric data and a consideration of the polar bonds, the following extraction formulae are postulated in organic phase: $TBP \cdot H_2O \cdot HNO_3$, $TBP \cdot HNO_3$, $TBP \cdot H_2O \cdot 2HNO_3$. The fields of existence, curves, and equilibrium constants for these are also given. The experimental results obtained are discussed. (auth)

5269

LOW-DECONTAMINATION-PROCESSING OF URANIUM DIOXIDE BY OXIDATION AND REDUCTION. Sydney Strausberg, T. E. Luebben, F. D. Rosen, Jerold Guon, and E. W. Murbach (Atomics International, Canoga Park, Calif.). Ind. Eng. Chem. 52, 45-6(1960) Jan.

Studies were made with uranium dioxide pellets to develop a procedure for low decontamination and preparation of a material suitable for refabrication to reactor fuel shapes. The pellets were pulverized to a finely divided powder by gaseous oxidation. The particle size of the oxidized power was significantly affected by operating temperature and oxidizing media; oxidation in air at about 375°C yielded a satisfactory product. The higher-oxide powder can be reduced back to uranium dioxide by treating with hydrogen at 650°C. The resulting −400 mesh powder is in a suitable form for adding and blending enriched material. Cold-pressed compacts made from this powder can be sintered to high-density fuel shapes and then returned to reactor use. (auth)

5270

CARRIER-FREE SEPARATION METHOD FOR RADIOACTIVE ISOTOPES. V. INDIUM AND CADMIUM BENZOYLACETONATES AND METHOD OF EXTRACTION SEPARATION OF RADIOACTIVE ISOTOPES OF INDIUM BY BENZOYLACETONE. N. P. Rudenko and I. Story. Radiokhimiya 1, 52-9(1959). (In Russian)

The stability constants of indium and cadmium benzoylacetonates were determined, and a carrier-free method for separating radioactive indium from irradiated cadmium is suggested. (R.V.J.)

5271

SEPARATION OF RARE EARTH ELEMENTS BY CONTINUOUS ELECTROPHORESIS. I. SEPARATION BY CITRIC ACID. V. P. Shvedov and A. V. Stepnov. Radiokhimiya 1, 112-15(1959). (In Russian)

The effects of complexing agent concentrations, solution pH, and concentration of rare-earth elements on the mobility of La, Ce, Pm, Eu, and Y ions were investigated. The experiments used radioactive indicators and citric acid as complexing agent in separation of La−Ce−Y−Eu and Ce−Pm mixtures. (R.V.J.)

5272

ON THE INFLUENCE OF THE DILUENT ON URANYL NITRATE EXTRACTION WITH TRIBUTYL PHOSPHATE. V. B. Shevchenko, A. S. Solovkin, I. V. Shilin, L. M. Kirillov, A. V. Rodionov, and V. V. Balandina. Radiokhimiya 1, 257-69(1959). (In Russian)

The influence of diluent on uranyl nitrate distribution between nitric acid and tributyl phosphate was investigated. The dipole moment of $UO_2(NO_3)_2 \cdot 2TBP$ was equal to $(3.1 \pm 0.02) \times 10^{-18}$. (R.V.J.)

5273

SEPARATION METHOD FOR Pa^{233}. I. E. Starik and L. D. Sheĭdina. Radiokhimiya 1, 270-72(1959). (In Russian)

Descriptions are given of Pa^{233} separation by coprecipitation with zirconium using amygdalic acid, followed by purification from zirconium by selective adsorption on filter glass surfaces. The method is fast and simple, does not employ hydrofluoric acid, and does not demand platinum apparatus. Yields are about 70% of Pa^{233} from the total content in irradiated thorium. (R.V.J.)

5274

CARRIER-FREE SEPARATION METHOD FOR RADIOACTIVE ISOTOPES. VII. SEPARATION BY MEANS OF ELECTRIC FIELD OF RADIOACTIVE In^{115m}, PRODUCED BY β DECAY OF Cd^{115}. Z. V. Pastukhova and N. P. Rudenko. Radiokhimiya 1, 273-6(1959). (In Russian)

A separation of In^{115m} from neutron-irradiated cadmium is achieved by collecting the recoil atoms by high-intensity electric field. (R.V.J.)

5275

CARRIER-FREE SEPARATION METHOD FOR RADIOACTIVE ISOTOPES. VIII. SEPARATION BY MEANS OF Tc^{99m} ELECTRIC FIELD AND APPLICATION OF THE METHOD FOR Nb^{97} AND Nb^{95}. N. P. Rudenko and Z. V. Pastukhova. Radiokhimiya 1, 277-82(1959). (In Russian)

A method is developed for separating the isotopes Tc^{99}, Nb^{97}, and Nb^{95} by collecting the recoil atoms in an electric field. A satisfactory quantitative extraction of Tc^{99} was achieved; however, for Nb^{97} the yield did not exceed 50%. It is shown that the method can be used for long-lived daughter products even with materials of high specific activity. (R.V.J.)

5276

ADSORPTION OF Nb AND Zr BY SILICA GELS. B. P. Nikol'skiĭ, A. M. Trofimov, and G. P. Panfilova. Radiokhimiya 1, 283-9(1959). (In Russian)

Silica gels were used for separating uranium from Zr^{95} and Nb^{95} and mixtures of their fragments. The equilibrium and adsorptive characteristics of the process and the adsorptive index taken under dynamic conditions are tabulated. The investigation of selective zirconium and niobium adsorption showed high adsorptive selectivity for niobium regardless of the content of nitric acid in the solution. The maximum zirconium adsorption was established at 0.5 to 1.0 N of HNO_3. The sorption of zirconium from 10 N HNO_3 is very weak while that of niobium is quite strong. Both zirconium and niobium are well adsorbed in weak acid solutions under dynamic conditions and poorly adsorbed

under static conditions. Zirconium–niobium complex formation lowers their selective adsorption. Satisfactory desorption of zirconium and niobium by oxalic acid was achieved. (R.V.J.)

5277

ELECTROLYTIC EXTRACTION OF MICROQUANTITIES OF URANIUM AND PLUTONIUM. G. S. Sinitsyna, S. L. Fadeev, and G. M. Sukhodolov. Radiokhimiya 1, 295-9 (1959). (In Russian)

The influence of current density, solution acidity, and cathode material on the electrolytic precipitation of uranium and plutonium is analyzed. The isotope U^{233} with $T = 1.6 \times 10^5$ years, with 3.6×10^{-5} g/l concentration, was used in the experiments. The separation of uranium and plutonium takes place after reaching the pH of hydroxide precipitation in the pre-cathode layer, regardless of the pH of the initial solution. The rate of uranium and plutonium separation on the cathode (Pt, Ni, Cu, Ta, Ag, Zr, and Cu amalgam) does not depend on the cathode material. (R.V.J.)

5278

PHYSICO-CHEMICAL CONDITIONS OF OCCURRENCE OF MICROQUANTITIES OF URANIUM IN GROUND WATERS. I. E. Starik, L. B. Kolyadin, and D. S. Nikolaev. Radiokhimiya 1, 317-20(1959). (In Russian)

The effects of pH and carbonate ion concentration on uranium precipitation and sorption from natural waters were studied with iron hydroxides, silicon acid gels, and humic acid. The obtained data show that microquantities of uranium (5×10^{-5} g/l) are adsorbed by ground water solutions with carbonate ion exceeding 10^{-7} N. Microquantities of uranium are easily adsorbed with pH 3 to 4 and carbonate ion concentrations less than 10^{-7} N. (R.V.J.)

5279

SEPARATION OF RADIOACTIVE INDICATOR Zr^{95} FROM Nb^{95}. V. M. Vdovenko, L. N. Lazarev, and Ya. S. Khvorostin. Radiokhimiya 1, 364(1959). (In Russian)

An attempt was made to separate Zr^{95} from Nb^{95} by adsorption from 10 M KNO_3 solution on spun glass. After two days the admixture of Nb^{95} was less than 0.05% (γ activity); after several months the indicator with adsorbent continued to be free from Nb^{95}. (R.V.J.)

5280

NITRIC ACID EXTRACTION BY DIBUTYL ETHER. V. M. Vdovenko and A. S. Krivokhatskiĭ. Radiokhimiya 1, 454-7(1959). (In Russian)

The extraction of nitric acid by dibutyl ether with an inert diluent at concentrations 0.6 to 6M follows the relation: $\log (C_0/C^2_{H_2O}) = \log K + n \log C_s$ (S is the extractant), where log K is a function of ion force and the nature of diluent. The dibutyl ether and water concentration in the organic phase is in proportion: $C_{H_2O} = A + hC_0$, where h = 0.5. Identical relations but with variant h hold in extraction by dibutyl ether mixtures with benzene, but do not hold for dibutyl ether mixtures with toluene, chloroform, and carbon tetrachloride. (R.V.J.)

5281

EXTRACTION OF Np^{239} FROM IRRADIATED URANIUM. E. S. Pal'shein and Yu. Z. Zolotov. Radiokhimiya 1, 482-7(1959). (In Russian)

An efficient extraction method is suggested for recovering radiochemically pure Np^{239} from irradiated uranium; the extraction is completed within 1 to 2 hours. The behavior of certain fragments during Np^{239} extraction by diethyl ether was analyzed. (R.V.J.)

5282

ON CONCENTRATION OF RADIOELEMENTS FROM LARGE VOLUMES OF NATURAL WATER. K. F. Lazarev and S. M. Grashchenko. Radiokhimiya 1, 493-6(1959). (In Russian)

Studies were made of the problems met in $Fe(OH)_3$ and $BaSO_4$ co-precipitation of low concentrations of thorium and radium from large volumes of natural water. The results of experiments made for achieving faster coagulation and settling of $Fe(OH)_3$ and $BaSO_4$ by adding an inversely charged colloid are tabulated. (R.V.J.)

5283

LAB DEVELOPS TABLE-TOP NUCLEAR FUEL SEPARATOR. Etienne Guerin. Research/Develop. 11, No. 1, 25-7(1960) Jan.

A flowsheet for a table-size nuclear fuel separator (the Asea Column), capable of refining five tons of uranium a year, is given. A pulse pump initiates a movement which is transferred through the series-coupled tubes containing perforated bottom plates by way of the organic overflow, with no mixing of the aqueous streams. An auxiliary circuit is provided for level control and crude removal in one operation. Advantages of the column are discussed. (C.J.G.)

5284

CYCLOHEXANONE EXTRACTION OF TANTALUM AND NIOBIUM FROM SULFURIC ACID SOLUTIONS. Ya. G. Goroshchenko, M. I. Andreeva, and A. G. Babkin. Zhur. Priklad. Khim. 32, 1904-13(1959) Sept. (In Russian)

Experiments confirmed the preferential extraction of Ta from mixtures with Nb in sulfuric acid and ammonium nitrate. Ta concentration in the aqueous phase was reduced to 0.03 to 0.04% of the initial value while Nb extraction did not exceed 70%. Extracted Ta is complexed as a fluosulfate which remains stable in sulfuric acid and ammonium sulfate washings while complexed Nb is worked out. (R.V.J.)

5285

EXTRACTION AND SEPARATION OF NIOBIUM AND TITANIUM BY OXALIC ACID AND ION EXCHANGE METHODS. I. D. Fridman and I. N. Yudina (Central Scientific Research Inst. of Geology and Exploration). Zhur. Priklad. Khim. 32, 1914-19(1959) Sept. (In Russian)

The extraction separation of niobium and titanium from oxalic acid solutions by anion resin EDE10P is achieved by selectively eluting niobium with 2M(10%) sodium chloride and titanium with 1M hydrochloric acid. The exchange volume of the resin for niobium is 5.5% of the dry-resin weight. A complete regeneration of the resin takes place during niobium and titanium extraction. The ion exchange method produces niobium pentoxide containing 98.0% Nb_2O_5 and 1.8 to 2% TiO_2. (R.V.J.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

5286 HW-62715

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TECHNICAL INVESTIGATION OF AUTOCLAVE FAILURE. N. G. Wittenbrock, M. D. Freshley, B. Griggs, and R. G. Wheeler. Nov. 18, 1959. 42p. Contract AT(45-1)-1350. OTS.

Investigation of an autoclave which ruptured while being used for thermal cycling studies of Plutonium Recycle Test

Reactor Al–Pu fuel elements is reported. Stand-in materials were being used and no contamination was involved. The failure was initiated by malfunction of the temperature control instrumentation which led to extreme overheating by the furnaces. Steam–metal corrosion reactions supplied the final increment of energy required to heat the autoclave to 950°C at which the autoclave failed at 1300 psig by stress rupture. No previously unrecognized chemical or physical phenomena contributed to the failure. A similar incident could not occur in a reactor unless the coolant system failed. (J.R.D.)

5287 NP-8205

General Electric Co. General Engineering Lab., Schenectady, N. Y.

DYNAMIC STABILITY ASPECTS OF CYLINDRICAL JOURNAL BEARINGS USING COMPRESSIBLE AND INCOMPRESSIBLE FLUIDS. B. Sternlicht, H. Poritsky, and E. Arwas. [1959]. 110p. Contract Nonr-2844(00).

Solutions of Reynolds equation are presented for cylindrical journal bearings in which the velocity of the journal center is considered, however, the inertia terms are neglected. Solutions are obtained for both compressible and incompressible fluids. Analysis of the steady state forces that exist in compressible fluid, externally-pressurized cylindrical journal bearings with one plane of feeding is also included. From these analyses the gradients of the radial and tangential forces with respect to displacement and velocity are obtained. The equations of motion for small and large oscillation in terms of these forces and gradients are set up, and stability criteria are established for small oscillations and for large oscillations of a massless rotor. Calculations for threshold of instability are given and, where existing experimental data are available, theoretical predictions are compared with results attained in practice. (auth)

5288 CEA-tr-A-610

UN INTERRUPTEUR SIMPLE POUR LE CONTROLE DE L'EAU DE REFROIDISSEMENT. (A Simple Interrupter for Control of Cooling Water). M. Wutz. Translated into French from Vakuum-Tech. 6, 193(1957). 4p.

A valve is described for turning off the heater of a diffusion pump when insufficient cooling water is available. The water passes through a box with a stand pipe or overflow which causes water to cover two electrodes. When insufficient water flows the electrodes are uncovered and current to the vaporizer heater is stopped. (T.R.H.)

5289 IGIS-32(RD/R)

DEFINITION OF WATER TREATMENT AND GENERAL CONTROL OF A HIGH PRESSURE BOILER WITH THE AID OF HYDROGEN ESTIMATION. A. Berger, J. Pirotte, and L. Bovyn. Translated by M. F. Sheppard (U.K.A.E.A., Risley) from Bull. centre belge étude et document. eaux(Liége), No. 37, 140-56(1957). 29p.

A technique is presented for the estimation of hydroger dissolved in the steam condensates and circuit water of a power station. This estimation is useful as a means of general control of the behavior of the installation and as a check on the effectiveness of chemical treatment in the boiler and preheater, insofar as these treatments aim to avoid corrosive deterioration. (W.D.M.)

5290

CORE FACTORS IN STATIC MAGNETIC SWITCH PERFORMANCE. Robert W. Durkee (Sandia Corp., Albuquerque, N. Mex.). Elec. Mfg., 4p. (1959) Oct.

Relationships between magnetic core permeabilities and output voltages were established for a magnetic option switch as used with a cold-cathode trigger tube. A description is given of the standard sine current production test which measures the "differential" or "instantaneous" permeability for all points along the hysteresis loop. The correlation factor K_c between the effective pulse permeability μ_e and the differential permeability μ_d were calculated as illustrations for the sine test. Determination of the effective pulse permeability of the core by the sine test enables calculation of the output current. The core can be re-wound with proper windings to obtain a measured output voltage to agree with the calculated value. (C.J.G.)

5291

ION DRAG PUMPS. Otmar M. Stuetzer (General Mills, Inc., Minneapolis). J. Appl. Phys. 31, 136-46(1960) Jan.

The behavior and the efficiency of a simplified model of an ion drag pump for insulating fluids are discussed theoretically. Supporting measurements on real pumps are reported. Cascading and paralleling of pumping stages are investigated. (auth)

5292

CRYOSTAT FOR REACTOR IRRADIATION IN LIQUID NITROGEN. G. Bortels (Studiecentrum voor Kernenergie, Mol, Belg.). J. Sci. Instr. 36, 511(1959) Dec.

A vertical liquid nitrogen cryostat is described. The liquid nitrogen is injected into the cryostat by an underpressure of about 130 mm of Hg from the normal reactor ventilation. Perlite is used as filling for the vacuum jacket surrounding the injection tube. (C.J.G.)

5293

A FEED SCREW POWDER SEAL FOR THE REACTOR TOWER. M. Collier (Goodyear Atomic Corp., Portsmouth, Ohio). Machine Design 31, No. 24, 118(1959) Nov. 26.

The two-way sealing of a feed screw for a fine powder conveyer is accomplished with a split gland. One end is externally threaded to receive the gland nut and the other end is flanged for bolting to a feed-screw housing. The correct installation of the gland is discussed. (C.J.G.)

5294

RADIOACTIVE SOURCES INDICATE AXIAL POSITION IN JET ENGINE. J. F. Coultry and H. D. Briggs (General Electric Co., Schenectady, N. Y.). Nucleonics 18, No. 1, 117-18; 20(1960) Jan.

A method for determining the distance between the stator and the rotor of a jet engine while in operation is discussed. A Co^{60} source was attached to the stator casing and another was placed in a hole drilled in a rotor bucket. By scanning and recording the energy peaks from the two sources, the distance between them could be measured directly from the recorder chart. This system has an accuracy of 1% of the full scan (3 in.). (B.O.G.)

5295

NONMAGNETIC HIGH-PRESSURE VESSELS. William Paul and G. B. Benedek (Harvard Univ., Cambridge, Mass.) and D. M. Warschauer (Lincoln Lab., Tech. Massachusetts Inst. of Lexington, Mass.). Rev. Sci. Instr. 30, 874-80 (1959) Oct.

The use of beryllium copper and stainless steel in the construction of pressure vessels to contain 20,000 kg/cm^2 is described. Machine drawings are given for the construction of different types of pressure vessels, different types of seal, and methods of introducing electrical leads into the apparatus. Experience in the use of high-pressure vessels and plugs beyond the elastic limit of the construction material is reviewed. (auth)

5296

MAGNETIC QUADRUPOLE WITH RECTANGULAR APERTURE. L. N. Hand and W. K. H. Panofsky (Stan-

ford Univ., Calif.). Rev. Sci. Instr. 30, 927-30(1959) Oct.

A magnetic quadrupole of rectangular aperture, employing current sheets bounded by iron rather than shaped pole faces to establish the field, is described. The performance of a rectangular quadrupole of aperture 4 × 23 in. is reported. (auth)

5297

ULTRAHIGH-VACUUM VALVE. Norman N. Axelrod (Univ. of Rochester, N. Y.). Rev. Sci. Instr. 30, 944-5(1959) Oct.

Two valve designs using molten indium are discussed. The discussion also includes an explanation of how the valves are actuated. (B.O.G.)

5298

METAL BAKEOUT VALVE FOR ULTRAHIGH VACUUM. Carsten M. Haaland (Armour Research Foundation, Chicago). Rev. Sci. Instr. 30, 947-8(1959) Oct.

Present Alpert-type high-vacuum valves are limited in application because of (a) inherent low conductance in the open position, (b) a finite conductance in the sealed position, and (c) a usual rapid increase of sealed-off conductance after a few bakeouts. The described valve overcomes these limitations, although it cannot be used as a controlled leak. The sealing element is a reservoir of pure tin. Cold drawn steel is used for the valve parts which are in contact with the tin in order to minimize erosive action. (B.O.G.)

Heat Transfer and Fluid Flow

5299 AECU-4507

Los Alamos Scientific Lab., N. Mex.

MEASUREMENTS OF AVERAGE HEAT-TRANSFER COEFFICIENTS FOR HELIUM AND HYDROGEN FLOWING IN SMOOTH TANTALUM TUBES AT HIGH SURFACE TEMPERATURES. H. J. Newman. [1959?]. 26p. Contract [W-7405-eng-36]. OTS.

An investigation of forced convective heat transfer was conducted with helium and hydrogen gas flowing through electrically heated smooth tantalum tubes with a long approach entrance, an inside diameter of 0.345 in., and a heated length of 8 in. at Reynold's numbers of 3.8×10^3 to 2.3×10^4, surface temperature at 2200 to 4600°R, and gas exit temperature at 925 to 1585°R. Satisfactory correlations of average heat transfer coefficients were made in terms of Nusselt's number, Reynolds' number, Prandtl's number, and length-to-diameter ratio for both helium and hydrogen when the physical properties of the gas appearing in these parameters were evaluated at the arithmetic mean of the tube inner surface temperature and gas bulk temperature. A description of a new high-temperature heat-transfer apparatus including some proposed investigations is given. (auth)

5300 AFBMD-TR-59-2

Avco Corp. Avco-Everett Research Lab., Everett, Mass.

VISCOUS AERODYNAMIC CHARACTERISTICS IN HYPERSONIC RAREFIED GAS FLOW. Research Report 48 (Revised). Ronald F. Probstein and Nelson H. Kemp. Dec. 1959. 66p. Contract AF04(647)-278.

Consideration is given to the problem of calculating viscous aerodynamic characteristics of blunt bodies at hypersonic speeds and at sufficiently high altitudes where the appropriate mean free path becomes too large for the use of familiar boundary layer theory but not so large that free molecule concepts apply. The complete Navier-Stokes equations are used as a model of the flow. In the stagnation region of blunt bodies they are reduced to ordinary differential equations, which can be handled numerically. Examples are calculated for a sphere and a cylinder, with emphasis on surface shear stress, surface heat transfer rate, and shock detachment distance. These show that as the Reynolds number decreases, the shear and heat transfer first increase above the value predicted by boundary layer theory at the same Reynolds number, and then fall off as the Reynolds number continues to drop. The maximum increase above boundary layer theory is about 20%. (auth)

5301 ARGMA-TN-1H1N-6

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.

ONE-DIMENSIONAL COMPRESSIBLE FLOW TABLES FOR A PERFECT GAS IN MACH NUMBER INCREMENTS OF 0.001 (k = 1.20) ISENTROPIC PROCESS. Cover carries title: COMPRESSIBLE FLOW TABLES k = 1.20 ISENTROPIC PROCESS. C. Hoebich. Dec. 1959. 90p. Project TW-205C.

Functions of Mach numbers for compressible perfect gas are tabulated. The ratio of specific heats k is 1.20. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate time-consuming interpolation. (auth)

5302 WADC-TR-57-482

Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.

TRANSIENT RESPONSE OF DOUBLE-FLUID HEAT EXCHANGERS. Vedat S. Arpaci, John J. Redlien, and John A. Clark. Oct. 1958. 96p. Project No. 7064. Contract AF33(616)-3157. OTS. (AD-210251).

The dynamic response of two-fluid heat exchangers to a time dependent temperature at the inlet of the primary fluid was experimentally investigated. A water-water system was used for three different flow rates. Data for both parallel and counter flows were obtained. The output response of the counterflow heat exchanger was correlated by a method taken from a recent paper by London et al. ("The Transient Response of a Two-Fluid Counter-Flow Exchanger—The Gas Turbine Regenerator," Tech. Report No. 32, August 1957, Dept. of Mech. Engineering, Stanford Univ.) (auth)

5303 NP-tr-328

HIGH TEMPERATURE HEAT TRANSFER MEDIA. (Vysokotemperaturnye Teplonositeli). A. V. Chechetkin. Translated from a publication of the State Publishing House of Power Engineering Literature, Moscow-Leningrad, 1957. 132p. OTS.

The properties of high-temperature heat carriers are described, and data for thermal aerohydrodynamic calculations of processes for heating by means of these carriers are presented. Plans for thermal installations and information concerning their construction and operation are included. (J.R.D.)

5304

DIGITAL CALCULATION OF TRANSIENT PERFORMANCE OF THE PRIMARY COOLANT SYSTEM IN A WATER REACTOR. D. G. Lewis (General Electric Co., Schenectady, N. Y.). Commun. and Electronics No. 40, 1036-43(1959) Jan.

The application of a digital computer for programming coolant flow under various transient conditions which might arise during normal operation in a primary coolant system is discussed. A flow diagram for the calculation

of derivatives is given. Equations are developed which describe the complete fluid system. (C.J.G.)

5305

FLOW RATES USING NUCLEAR OR ELECTRON PARAMAGNETIC RESONANCE TECHNIQUES WITH APPLICATIONS TO BIOLOGICAL AND CHEMICAL PROCESSES. J. R. Singer (Univ. of California, Berkeley). J. Appl. Phys. 31, 125-7(1960) Jan.

The equations for measuring flow rates are derived using NMR and EPR relaxation time determinations. Several experimental procedures are discussed. One method of measurement depends upon the difference between static relaxation times and the apparent relaxation time of materials flowing through the observation region. Another procedure utilizes saturated or inverted spins as a "tracer" to measure flow rates. These schemes may readily be applied to blood flow velocity measurements in humans or animals, or to mineral and chemical flow rate determinations. The advantage of this spin resonance flowmeter is that the flow channel is not disturbed. Thus blood flow velocities are readily measured without the necessity of breaking the skin. (auth)

5306

CONDENSATION IN A REACTOR CONTAINMENT VESSEL. D. H. Jubb (Rolls-Royce Ltd., [Littleover, Derby, Eng.]). Nuclear Eng. 4, 431-4(1959) Dec.

Tests were performed to determine whether the loss of heat by a contained mixture of steam and air is sufficient to cause any substantial alleviation of pressure built up in a reactor containment vessel. Steam was injected into the boiler at 120 psig and assumed to be 3% wet. The results were analyzed in terms of forced convection heat transfer (steam injection period) and free convection heat transfer. Two formulas were derived for calculating the heat loss to a containment vessel by a steam-air mixture. (C.J.G.)

5307

HEAT TRANSFER TO BINGHAM PLASTICS IN LAMINAR FLOW THROUGH CIRCULAR TUBES WITH INTERNAL HEAT GENERATION. R. S. Schechter and E. H. Wissler (Univ. of Texas, Austin). Nuclear Sci. and Eng. 6, 371-5 (1959) Nov.

An analytic solution was obtained for a problem arising in the flow of a Bingham plastic through a circular tube with constant internal heat generation. The associated eigenfunctions were evaluated numerically, and the resulting eigenvalues are tabulated. Using these eigenfunctions a solution can be obtained for arbitrary heat generation and wall flux. (auth)

5308

HEAT TRANSMISSION IN ANNULI. INFLUENCE OF IRRADIATION. Gino Parolini (Istituto di fisica tecnica della Facoltá di ingegneria, Rome). Ricerca sci. 29, 2390-2404(1959) Nov. (In Italian)

The adimensional relations available for the computation of heat transmission from the inner pipe in annuli fail to consider the effects caused by irradiation. Some theoretical relations were used to evaluate the incidence of these effects on the total transmission. An apparatus was built to determine by tests the effects and their influence upon the results of some physical parameters from which, in the present case, the transmissions by radiation and by convection mainly depend. Theoretical data and test results show a satisfactory agreement. (auth)

5309

PRINCIPLES OF HEAT TRANSFER. Frank Kreith. Scranton, International Textbook Company, 1958. 560p.

A basic introduction to the field of engineering heat transfer is presented. Equations governing heat flow and electric current flow are utilized to develop an analogy between electrical and thermal systems. Numerical, graphical, and electrical-model-analogue methods are applied to conduction heat transfer problems. A modified analogue-network method was applied to the solution of radiant-heat-transfer problems. Interrelationship between flow of heat and flow of the fluid in convection heat transfer is emphasized. Prandtl's concept of the boundary layer is presented, and the problem of flow over a flat plate is treated. The use of the Buckingham pi theorem in dimensional analysis is presented and several pertinent examples are given. The European method of deducing similarity parameters from differential equations is illustrated. Heat transfer in boiling and condensing fluids is treated, with melting and freezing processes also being considered. The analogy between the transfer of mass, heat, and momentum is discussed. The design and thermal analysis of heat exchangers are discussed. (C.J.G.)

Instrumentation

5310 AECL-805

Atomic Energy of Canada Ltd., Chalk River, Ont.

PROCEEDINGS OF THE SIXTH TRIPARTITE INSTRUMENTATION CONFERENCE HELD AT CHALK RIVER, ONTARIO, APRIL 20-24, 1959. PART 5: RADIATION DETECTORS. J. E. Woolston and S. J. Townsend, eds. Aug. 1959. 84p. (AECL).

Twelve of fourteen papers are included on various aspects of radiation detector design. Abstracts were prepared for each paper. (J.R.D.)

5311 AECL-805(Paper 5.1)

Argonne National Lab., Lemont, Ill.

ION CHAMBERS FOR REACTORS. William W. Managan. 10p.

Some experimental work on ion chambers for use in reactors was done since the last Tripartite Instrumentation Conference (Brookhaven, November 1956) to provide design information. The measured response for different thicknesses of elemental B^{10} showed a broad maximum from 0.4 to 0.7 mg/cm^2 followed by a loss of sensitivity at greater thicknesses. Saturation curves of current versus voltage were obtained for gas fillings of hydrogen, nitrogen, and argon using a gas thickness of 0.093 in. between parallel plates, having 157 cm^2 of the collector only coated with elemental B^{10}. Design curves of current/cm^2 versus voltage for 95% of saturation current were constructed from these data. Design of parallel-plate ion chambers for high sensitivity and high current output based on these experimental studies are described. (auth)

5312 AECL-805(Paper 5.3)

United Kingdom Atomic Energy Authority, Research Group, Atomic Energy Research Establishment, Harwell, Berks, England.

IN-PILE IONIZATION CHAMBERS. J. A. Dennis. 2p.

These chambers are being developed to monitor the neutron-flux levels in the cores and reflectors of graphite-moderated, gas-cooled power reactors. The chambers should work in a temperature of 480°C and withstand an external pressure of 300 lb/in.^{2} of carbon dioxide. A sensitivity of 100 μA in 10^{13} n/cm^{2}s was called for, with an output which is linear to within ±1% in the range 5×10^{12} n/cm^{2}s to 10^{13} n/cm^{2}s. Preliminary experiments were made with xenon, nitrogen and neon to decide the best gas, gas pressure and electrode spacing. Indications are that a

1-mm electrode spacing will be used with a half-atmosphere filling of xenon. (auth)

5313 AECL-805(Paper 5.4)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RC6 AND RC7 IONIZATION CHAMBERS. R. P. Henderson. 5p.

Ionization chambers intended for slow-neutron flux measurements in nuclear reactors are described. They are 3.5 in. diameter, approximately 13.5 in. long and weigh 3.5 lb. The chambers may be operated at 200°C or less, even with low gas pressures, the limitation being due to collapsing of the outer aluminum case. Somewhat higher temperatures (250 to 300°C) can be withstood for gas pressures ~1 atm. (auth)

5314 AECL-805(Paper 5.5)
Atomic Energy of Canada Ltd., Chalk River, Ont.
LARGE BF_3 COUNTERS. I. L. Fowler. 8p. (CRR-797-5.1).

Design descriptions of two BF_3 neutron counters for use in nuclear-physics experiments on the tandem accelerator and for other cosmic-ray studies are presented. (J.R.D.)

5315 AECL-805(Paper 5.6)
Atomic Energy of Canada Ltd., Chalk River, Ont.
FISSION COUNTERS FOR NEUTRON MONITORING. J. M. McKenzie. 4p.

Fission counters for neutron monitoring are described. Two basic types were made, although several variations of these were developed for particular applications. One type is cylindrical and is used for monitoring isotropic fluxes in the range $10-10^6$ n/cm^{2}s, while the other type, of parallel-plate form, is for monitoring neutron beams in the range $5\times10^5-5\times10^9$ n/s. The counter bodies are made of aluminum, the anode lead is brought out through a copper-to-glass seal, and the internal insulators are quartz. (J.R.D.)

5316 AECL-805(Paper 5.7)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
HIGH-TEMPERATURE FISSION CHAMBERS. P. G. Salmon. 5p.

Chambers complete with 15-ft rigid extensions were made for flux scanning and reactor control. Stainless steel is used throughout and all insulators are made from alumina. The gas volumes of the chambers are confined by ceramic-to-metal seals; this avoids gas migration which would otherwise occur under uneven heating conditions. Chambers filled to 50 lb/in.^{2} with a confined gas volume were heated to 500°C under laboratory conditions for a period of eight months and are still giving good results. These chambers and extensions were also heated in air to 650°C for one hour and filled to 50 lb/in.^{2} with argon. A resistance of better than 10^{14} Ω was obtained at room temperature and $10^{10}-10^{11}$ Ω at 500°C and, after this treatment, these resistances were maintained over a period of months with chamber and extension at 500°C. (J.R.D.)

5317 AECL-805(Paper 5.8)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
0.25-in. FISSION CHAMBER WITH CADMIUM SLEEVE. P. G. Salmon. 2p.

A chamber with a 15-ft flexible cable used for neutron-flux scanning in reactor-core assemblies is described. It may be passed through a tube of 0.25-in. internal diameter. A nut is moulded into the cadmium sleeve which screws to the end of the chamber. This facilitates the easy removal of the sleeve and obviates the possibility of accidental sleeve detachment. By using U^{235}, Pu^{239}, and other coatings, it is possible to get an estimate of the neutron energies in the reactor. In particular the ratio of slow to fast neutrons can be measured from the ratio of the count-rate with and without the cadmium sleeve. A count-rate ratio of 1000 : 1 was measured in a homogeneous thermal-neutron flux by the use of the cadmium sleeve. The working temperature is limited by the cable to about 100°C. Care is taken to coat only the lower end of the chamber in order to minimize the number of neutrons that can enter the chamber from the cable end without being intercepted by the cadmium. The small dimensions of the coated area have obvious advantages when it is necessary to determine accurately the neutron flux at a given position in a small reactor assembly. The coated area is approximately 0.5 cm^2. (auth)

5318 AECL-805(Paper 5.9)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
^{235}U-COATED IONIZATION CHAMBER, TYPE IZ/400. M. L. Awcock. 2p.

An instrument designed for measurement of the thermal-neutron flux in a zero-energy, high-temperature reactor is described. The chamber is 1.5 in. in diameter by 13 in. long, and the over-all length of the chamber and extension leads is approximately 13 ft. Stainless-steel construction is used throughout, with alumina insulators and ceramic-metal seals. The alumina spacers along the collector extension lead are spaced at 18-in. intervals while extension lead is insulated along its entire length with fish-spine beads. The filling gas is 99.99% argon at a pressure of 53.7 cm of mercury (at 20°C) in the ion chamber. The leads are filled to approximately one atmosphere. Both electrodes are coated with U^{235} to a thickness of 0.3 mg/cm^2 over a total area of 400 cm^2. The electrode spacing is 0.3 mm. The operating temperature of these instruments in the reactor ZENITH will be approximately 250°C, so, to give a margin of safety, all sensitivity tests and insulation measurements were carried out at 330°C. (auth)

5319 AECL-805(Paper 5.10)
Argonne National Lab., Lemont, Ill.
SCINTILLATION COUNTERS. William W. Managan. 15p.

Thallium-activated sodium iodide [NaI(Tl)] for gamma-ray and charged-particle spectrometry is described. Items described include a sandwich-type double crystal and (ΔE.E) product coincidence circuit for particle-mass and -charge discrimination in deuteron-scattering experiments, a gamma spectrometer using a 4 in. × 4 in. cylindrical NaI(Tl) crystal, the facilities for machining and packaging hygroscopic scintillators, and the current development status of sodium iodide scintillators. (auth)

5320 AECL-805(Paper 5.11)
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
PHOTOMULTIPLIER FATIGUE. J. N. Wilson. 5p.

The study of fatigue effects in photomultipliers was continued to include a study of the internal mechanism of fatigue in photomultipliers. Photomultiplier fatigue was found to be caused by surface changes on the dynodes of the electron multiplier due to electron bombardment. Two surface fractions that are major contributors to the process are cesium and oxygen. Some specially designed tubes

were built and are being studied in an effort to determine the contribution each makes to the over-all fatigue. Design of test equipment and results are described. (auth)

5321 AECL-805(Paper 5.13)
Atomic Energy of Canada Ltd., Chalk River, Ont.
GOLD–GERMANIUM JUNCTIONS AS PARTICLE SPECTROMETERS. J. M. McKenzie and D. A. Bromley. 3p.

The junctions are formed by sputtering a very thin layer of gold on a prepared germanium surface. The charged particles enter the junction through the gold layer. To obtain a spectrum of particle energies expended in the junction, the current pulse from a reversed-biased junction is integrated by the RC network formed by the junction self-capacitance in series with a high resistance. These pulses, after suitable amplification and differentiation, are analysed with a kicksorter. Results obtained using protons, deuterons, ^{3}He and ^{4}He ions show that the output pulse is proportional to the incident particle energy – provi.'ed the particle range does not exceed the effective junction thickness. Also, the pulse height is not dependent on the type of particle provided the junction bias is maintained above a minimum value (~1 V) required to prevent recombination. (auth)

5322 AECL-805(Paper 5.14)
Oak Ridge National Lab., Tenn.
SEMICONDUCTOR RADIATION DETECTORS. J. L. Blankenship. 2p.

Gold-germanium surface-barrier diodes were made and used as alpha and fission-fragment detectors. A poor-vacuum evaporation technique is used to deposit a layer of gold, the thickness of which varies from 200 to 2000 A. About twenty successful units, ranging from 3 mm × 3 mm square to 1 in. diameter, were constructed. The amplitudes of the voltage pulses produced by alpha particles and fission fragments were compared, and found to be approximately linear with energy. The rise-times of the voltage pulses were about 10 ns and were at the limit of instrumentation capabilities. In another detector, four cubes of gold diffusion-doped silicon single crystals were used for gamma-radiation. Each cube was 1 cm on an edge. Two opposite faces were lapped and electroless-nickel-plated, and the remaining four faces were lapped and etched to produce a surface with low leakage. When a biasing voltage was applied to the nickel-plated faces, charge carriers produced by ionizing radiation were collected. Performance and applications of these detectors are described. (J.R.D.)

5323 AECU-4554
Case Inst. of Tech., Cleveland.
A REGULATED POWER SUPPLY FOR A HIGH CURRENT MAGNET. Technical Report No. 6. Richard B. Block. July 1959. 35p. Contract AT(11-1)-623. OTS.

Current regulation of a Bitter-type electromagnet powered by a 10 kw motor-generator set was achieved by control of the generator exciting field. An error signal, obtained by comparing the voltage drop across a series resistor in the magnet circuit with a reference voltage, is fed back with appropriate amplification to the grids of series tubes in the generator field supply. Magnetic fields from 400 gauss to 10 kilogauss in a fixed gap (1.5 in. width and 3.5 in. diameter) are obtainable with regulation to 3 parts in 104 over the major part of this range. (auth)

5324 ARF-1151-3
Illinois Inst. of Tech. Armour Research Foundation.
MAGNETIC RECORDER FOR NUCLEAR PULSE APPLICATION. Period covered: October 6, 1959 to December 5, 1959. G. M. Burgwald and R. M. Norton. Dec. 14, 1959. 12p. Contract AT(11-1)-702. OTS.

Data on analog magnetic tape characteristics are presented along with results from conventional and modulator playback system operational tests. Theoretical considerations imply that the modulator head should be less sensitive to short term variations in record and playback tape speed. It is also pointed out that although a tape recorder operating at 7.5 in./sec has only 12 kcs bandwidth for sinusoidal wave forms, the record and playback amplifiers for pulse recording can operate with other bandwidths. These amplifiers must be capable of passing a square wave with a frequency of 1.5 kcs. A square wave of such frequency represents the condition of 350 microsecond pulses with a 700 microsecond period. (J.R.D.)

5325 CEA-942
France. Commissariat à l'Énergie Atomique, Paris.
LIMITE DES POSSIBILITES DE MESURE DE FAIBLES ACTIVITES AU MOYEN DE CHAMBRES D'IONISATION. (Limit to the Measurement of Low Activities Using Ionization Chambers). M. Briere. 1958. 27p.

A method based on experience acquired in the Biology Service, in measuring low activities of tritium and carbon-14 is presented. Precisions are given on the behavior and actual performance of vibrating condenser electrometers, based on approximately two years' operating experience. It is shown that the possibilities of utilization are not limited as is generally believed by insufficient sensitivity and stability of the electronic equipment, but by the existence of various parasitic phenomena coming from the ionization chamber itself, which make very difficult the measurement of ionization currents which are less than 10^{-14} a. (auth)

5326 CEA-945
France. Commissariat à l'Énergie Atomique, Paris.
L'ELECTRONIQUE RAPIDE EN PHYSIQUE DE HAUTES ENERGIES. (High-speed Electronics in the Field of High-energy Physics). R. Meunier. Dec. 1958. 14p.

An extensive technical development of particle counting in the field of high-energy physics near any large modern accelerator is a necessary condition for efficient work with its beams of particles. A review is presented on the basic principles of more commonly used circuits, with special emphasis on the explanation of the limits of their use. (auth)

5327 CERN-59-37
European Organization for Nuclear Research, Geneva.
A CONVENIENT TRANSFORMER FOR MATCHING COAXIAL LINES. P. Bramham. Nov. 1959. 17p.

A line transformer is described which involves two sections of line each having the impedance of one of the lines to be joined, and arranged so that the three resulting changes of impedance cancel at one frequency. It is shown that in certain cases the transformer has practical advantages over other types in common use. The bandwidth of the transformer is calculated, and comparison is made with the quarter-wave transformer and with the half-wave taper. (auth)

5328 CF-59-11-70
Oak Ridge National Lab., Tenn.
CONSOLIDATED MCF-1400 OIL DIFFUSION PUMP. C. E. Normand. Nov. 18, 1959. 18p. OTS.

Test and modification of a 10 in., four-stage fractionating pump having an enlarged boiler compartment and external heaters are described. Measurements and observations of the pump as originally supplied are presented, and

pump modifications are outlined with a discussion of their effects on performance. (J.R.D.)

5329 HW-59410

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SCRATCH DEPTH MEASUREMENT METHODS. B. B. Brenden. Feb. 26, 1959. 11p. Contract [AT(45-1)-1350]. OTS.

Judging scratch depth or surface roughness by unaided visual inspection under controlled conditions, while rapid and popular, is not quantitative. Depth measuring microscopes are particularly applicable to measurement of pinhole depth but do not graphically reveal profiles and provide only a small field of view. The comparatively large field of view and graphic display of contour provided by profile microscopes make them particularly suitable for evaluation scratch depth as well as surface roughness. A HAPO-constructed instrument demonstrated an accuracy of ±50 microinches in the range of 50 to 15,000 microinches scratch depth. It is pocket-sized, portable, and can be used on horizontal and vertical surfaces by untrained persons with only brief instruction. (auth)

5330 HW-60631

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A SCINTILLATION TRANSISTORIZED ALPHA-BETA-GAMMA HAND AND SHOE COUNTER. W. G. Spear. July 27, 1959. 105p. Contract AT(45-1)-1350. OTS.

The instrument was developed to provide an efficient, sensitive, reliable method of determining the extent of radioactive contamination on the hands, shoes, and clothing of personnel employed at the Hanford Atomic Products Operation, General Electric Company, Richland, Washington. The instrument can simultaneously detect and indicate radioactive contamination levels for alpha and beta particles and gamma photons which are produced by disintegration of radioisotopes. The instrument replaced, in one unit, two separate instruments of vacuum tube types designed for the same purpose. With the new instrument, complete personnel contamination determination is accomplished in less than one-half the time previously used. The new instrument has more than twice the detection sensitivity of either of the previous vacuum tube instruments. Multiplier phototubes and scintillating crystal detectors are used in the new instrument to achieve a reliability not obtainable with the air proportional chambers and Geiger-Mueller tubes used for alpha and beta-gamma detecting, respectively, in the two older instruments. (auth)

5331 HW-60661

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DESIGN AND EVALUATION OF HAPO CANNED MOTOR SCREW PUMP. J. Dunn. June 19, 1959. 6p. Contract AT(45-1)-1350. OTS.

The two horsepower HAPO canned motor screw pump, fabricated basically from a standard electric motor operated completely trouble-free and without attention for 515 days. Operation was continuous, 24 hours per day and involved pumping of water at a nominal discharge rate of 25 gpm against a head of 2.5 feet. Final inspection revealed wear of the graphitic bearings to be less than that encountered in standard deepwell turbine pumps in similar service. (auth)

5332 HW-61117

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN AUTOMATIC ANALYZING MONITOR FOR REACTOR EFFLUENT COOLING WATER. H. G. Rieck, C. A. Ratcliffe, and L. C. Schwendiman. May 1, 1959. 69p. Contract W-31-109-Eng-52. OTS.

An automatic analyzing monitor was designed, fabricated, and tested to record the concentrations of predominant isotopes in a reactor coolant effluent stream. The monitor combines three basic operations to determine isotope activity in the waste stream. A mechanical operation meters the sample volume to a cup and manipulates the sample through subsequent drying and counting positions. A chemical operation prepares the sample through removal of interfering isotopes. A counting operation measures the selected isotope radioactivity and records the result. Samples of the waste stream are automatically prepared in 0.010 inch aluminum dishes 2 inches in diameter by ¾ inch high. The monitor then measures and records the beta emission rate of the total sample and concentrations of Na^{24}, As^{76}, Np^{239}, Mn^{56}, Cu^{64}, Si^{31}, and P^{32} in the samples. (auth)

5333 NAA-SR-4433

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

IMPROVED ALPHA SPECTROSCOPY USING A MODIFIED FRISCH GRID IONIZATION CHAMBER AND A 256-CHANNEL ANALYZER. T. B. Crockett, T. T. McMillan, and J. W. Crowe. Jan. 1, 1960. 22p. Contract AT-11-1-GEN-8. OTS.

Adaptation of a Frisch Grid alpha ionization chamber and its preamplifier to an Argonne-type 256-channel pulse height analyzer for alpha spectroscopy is described. Overall resolution of better than 1% is achieved. Circuit modifications to the commercial preamplifier are given, and a procedure for electrodeposition of thin samples is described. (auth)

5334 NAA-SR-Memo-4127

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

TRANSIENT TESTS OF HNPF PROTOTYPE SODIUM PUMP DRIVES. R. W. Atz. Oct. 19, 1959. 7p. OTS.

The objectives of this study were to demonstrate that the pump speed control system will respond as defined in the equipment specifications and to determine optimum values of controlling variables that will minimize the oscillations that occur in the Na flow rate when transient signals are imposed on the pump speed control system. (W.L.H.)

5335 NAVORD-5749

Naval Ordnance Lab., White Oak, Md.

A BETA-RAY GAGE FOR MEASURING THE THICKNESS OF THIN MAGNETIC TAPE. Hugh Maillie and Norman Modine. Oct. 10, 1957. 13p.

A beta-ray thickness gage was developed to measure ultra-thin magnetic tapes without removing them from the roller. The optimum choices of source and detector for this application were determined by a study of available beta emitters and types of detectors. The best source was a linear deposit of 5 microcuries of carbon-14 as sodium carbonate. The best detector was an end window Geiger tube feeding an automatic scaler. The gage was calibrated for molypermalloy tape ⅜" wide and from 0.0001" to 0.001" thick. A standard error of ±½% was achieved with counting times of a few minutes. (auth)

5336 NRL-5295

Naval Research Lab., Washington, D. C.

PROTOTYPE MODEL OF AN AUTOMATIC X-BAND MICROWAVE IMPEDANCE RECORDER. W. F. Gabriel. Feb. 17, 1959. 34p. Project NR-411-000.

A prototype model of an automatic X-band microwave

impedance recorder was developed and tested. The design of this unit, manufactured commercially under contract, is based upon an earlier NRL model. The new instrument is neatly packaged in two portable cabinets and, as regards electrical performance, is fast, accurate, broadband, and has a dynamic range of about 40 db. It will accept any impedance which has an X-band waveguide input and will plot either the impedance or admittance upon either a standard or an expanded Smith chart. Amplitude and phase indicators can be located remotely if desired. The impedance terminals of the instrument may be located at any desired point and will remain fixed over the band. In addition to impedance measurements, the instrument is particularly well suited to the measurement of dielectric constant, using the shorted-line method. A chart can be constructed which permits rapid, automatic dielectric constant measurements with accuracy comparable to the Von Hippel slotted-line technique. Loss tangent of dielectric materials can also be measured, and a shorted-line technique for accomplishing this was developed. With slight modification of the accessible rf circuit, the instrument may be adapted to the automatic measurement of transmission coefficient. Also, if a suitable field probe and carriage movement are available, the instrument may be adapted to automatic antenna near-field measurements. (auth)

5337 NYO-2561

Franklin Inst. Labs. for Research and Development, Philadelphia.

THE INFLUENCE OF SURFACE DIFFUSION PHENOMENA ON THE FORM OF VACUUM GROWN ZINC CRYSTALS. James B. Drew. Sept. 1959. 21p. Contract AT(30-1)-1484. OTS.

Zinc crystals grown from the vapor phase show evidence of layer growth and hexagonal habit. Ridge boundaries are suggested as causing nucleation of growth pyramids far from crystal edges. The growth of crystallographic pyramids is consistent with a mean surface diffusion distance larger than the atom spacing but equal to or on the order of the distance between kinks. An evaporation chamber has been designed and constructed which allows zinc crystals to be cleaved under vacuum (10^{-6} mm Hg). The apparatus has an evaporation arrangement by which the cleaved surfaces can be quickly evaporated upon thus reducing the degree of surface contamination. Growth pyramids grown in this chamber clearly demonstrate the influence of the substrate on the form of the final deposit. (auth)

5338 ORNL-2587

Oak Ridge National Lab., Tenn.

THE LID TANK SHIELDING FACILITY AT OAK RIDGE NATIONAL LABORATORY. PART III. INSTRUMENTATION. D. W. Cady. Jan. 18, 1960. 63p. Contract W-7405-eng-26. OTS.

The instrumentation at the Lid Tank Shielding Facility (LTSF) is described. Drawings or photographs of the gamma-ray, thermal-neutron, and fast-neutron detectors are included, and these detectors are discussed. The methods of detector application at the LTSF are also described, as well as the calibration techniques. The electronics associated with each detector is presented with appropriate references. The range of sensitivity of each detector is also given, along with estimates of the reliability of data from the detection system. (auth)

5339 SCTM-163-59(52)

Sandia Corp., Albuquerque, N. Mex.

TRANSISTORIZED MICROPHONE PREAMPLIFIER PA-LD. Melvin H. Brock. Apr. 27, 1959. 10p. OTS.

A transistorized microphone preamplifier which is capable of driving a 500-ohm balanced transmission line at 0-dbm level is described. It is intended for service in test range interstation communications systems. (auth)

5340 SCTM-279-56(14)

Sandia Corp., Albuquerque, N. Mex.

APPLICATION OF THIN PRINTED WIRING LAMINATE IN ELECTRONIC PACKAGING. George Voida. Jan. 8, 1957. 38p. OTS.

The use of flexible printed circuits in electronic packaging applications is discussed. The wiring is printed on very thin copper-clad laminates consisting principally of epoxy resins and reinforcement materials. Specifically considered here are the types of materials and their availability, conductor-laminate bond strength properties, shaping characteristics, and processing and operating stability. (auth)

5341 SCTM-306-59(14)

Sandia Corp., Albuquerque, N. Mex.

THE T-ANTENNA: CURRENT AND IMPEDANCE. Ronold W. P. King and Charles W. Harrison, Jr. Sept. 15, 1959. 37p. OTS.

An analysis is made of the T-antenna with image in order to determine the distributions of current in both the horizontal top load and the vertical wire. Approximate formulas are derived in a simple form that involves only trigonometric functions and appropriate complex coefficients. An expression is obtained for the driving point impedance. The investigation takes account of capacitive and inductive coupling between parts of the structure. (auth)

5342 SCTM-353-59(14)

Sandia Corp., Albuquerque, N. Mex.

THE INVERTED L-ANTENNA: CURRENT AND IMPEDANCE. Ronold W. P. King and Charles W. Harrision, Jr. Nov. 2, 1959. 14p. OTS.

The distribution of current and the driving point impedance for an inverted L-antenna with image are obtained from the solution of the corresponding problems for T-antennas. (auth)

5343 UCRL-5772-T

California. Univ., Livermore. Lawrence Radiation Lab.

THE THEORY AND OPERATION OF SHOCK-LOADED FERROELECTRIC TRANSDUCERS. M. T. Abegg, R. W. Kuenning, P. L. Phelps, Jr., and H. M. Graham. Nov. 1959. 43p. Contract W-7405-eng-48. OTS.

Domino-shaped ferroelectric ceramic pieces were stacked together and explosively shocked, with the direction of shock travel normal to the direction of ceramic polarization. A commercial grade of barium titanate ceramic was used. It was found that the current output from a ceramic element is proportional to the width of the element. The voltage output is proportional to the thickness and the pulse duration to the length of the element in the direction of shock travel. (J.R.D.)

5344 UCRL-8954

California. Univ., Berkeley. Lawrence Radiation Lab.

EVALUATION OF HIGH-SPEED TWO-TUBE CONFIGURATIONS. PART I. GREATER GAIN-BANDWIDTH IN TRIGGER CIRCUITS. PART II. TRANSIENT ANALYSIS OF THE WHITE CATHODE FOLLOWER (thesis). Melvin Brown. Nov. 1959. 60p. Contract W-7405-eng-48. OTS.

The relation between switching speed of a trigger circuit and the gain band width (GBW) of an amplifier is discussed. A series connection of two tubes, referred to as a dynamic plate-load amplifier (DPL), is also presented and analyzed. A d-c analysis shows that the DPL investigated has 18% of the output impedance and 2.75 times the d-c gain of a con-

ventional amplifier. A transient analysis shows that the DPL may have 3 times the advantage in GBW over a conventional amplifier. The GBW is recommended for utilization in fast trigger circuits. A regeneration analysis of the DPL trigger circuit is included. The White cathode follower, a two-tube series device that provides output impedances of the order of 5 ohms, which transmits pulses of either polarity with minimal distortion is described. A d-c and transient analysis of the White cathode follower is made and a typical circuit analyzed. The effect on the transient response of varying the circuit parameter is discussed and throughout the paper the White cathode follower is compared with the well-known conventional cathode follower. The White cathode follower may have an advantage in gain bandwidth over the conventional cathode follower by a factor of five. (auth)

5345 USNRDL-TR-380

Naval Radiological Defense Lab., San Francisco.
A SEARCH FOR AN IMPROVED NEUTRON SPECTROMETER. R. L. Mather, P. J. Cressman, and J. R. Hubbard. Oct. 30, 1959. 21p.

A neutron spectrometer utilizing a lithium-containing scintillator is proposed. The proposal is based on the ability to distinguish the (n,α) reaction from other events by pulse-shape analysis. The ability to distinguish neutron events from gamma-ray events in stilbene by pulse-shape techniques was demonstrated experimentally. A pulse-shape effect was looked for in a commercial $Li^6I(Eu)$ scintillator without success. The literature was searched for other lithium-containing phosphors which might show the effect. (auth)

5346 AEC-tr-3932

IMPROVEMENT IN THE ENERGY RESOLUTION OF THE PULSE IONIZATION CHAMBER WITH GRID. B. A. Bochagov, G. Ye. (E.) Kocharov, and G. F. Kirshin. Translated by Lydia Venters (Argonne National Lab.) from Pribory i Tekh. Ekspt., No. 6, 72-4(1957). 6p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 10860.

5347 AEC-tr-3933

BACKGROUND DECREASE IN THE MEASUREMENTS OF LOW ACTIVITIES IN LIQUID SCINTILLATION COUNTERS. D. G. Fleishman and L. G. Shakhidzhanyan (Shakhidzhanian). Translated by Lydia Venters (Argonne National Lab.) from Pribory i Tekh. Ekspt. No. 1, 135-6(1959). 5p. JCL or LC.

Measurements are reported of the radioactivity of the materials used in constructing scintillation counters. A significant activity was disclosed in the glass containers of photomultipliers and in mica used in some counters. (C.H.)

5348 AEC-tr-3935

TOROIDAL β-SPECTROMETER FOR INVESTIGATING THE CONVERSION RADIATION WHICH ACCOMPANIES α-DECAY. E. F. Tret'yakov (Tret'iakov), L. L. Gol'din, and G. I. Grishuk. Translated by Lydia Venters (Argonne National Lab.) from Pribory i Tekh. Ekspt., No. 6, 22-30 (1957). 15p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 10850.

5349 AEC-tr-3937

POTENTIAL DISTRIBUTION IN A SPHERICAL CONDENSER UNDER CONDITIONS OF SATURATION CURRENT. R. P. Poplavskii. Translated for Los Alamos Scientific Lab. from Zhur. Tekh. Fiz. 20, 149-59(1950). 13p. JCL or LC.

The recent work of Kan presented the exact solution to the problem of the potential distribution in a spherical condenser with thermionic current and limited space charge. The possibility of generalizing the solution for a number of cases and particularly for the case of saturation current was investigated. (W.L.H.)

5350 CEA-tr-X-74

MESURE RADIOLOGIQUE DE L'ÉPAISSEUR AU COURS DU LAMINAGE À CHAUD. (Radiological Measurement of Thickness During Hot Rolling). H. Warrol and B. Wahlber. Translated into French from Jernkontorets Ann. 140, 907-29(1956). 35p.

A brief survey is presented of the technique of radiological measurement without contact with the object. The principles and practical applications of the method are described. A discussion of the correlation between the precision and divergence of time and the radiation intensity and type of detector is included. Experimental work reported involves x- and gamma-ray sources and an industrial apparatus. The importance of building equipment to withstand shock, vibration, temperatures, pressures, and humidities when used in hot rolling was demonstrated. (T.R.H.)

5351

RELAY-TYPE FEEDBACK CONTROL SYSTEMS WITH DEAD TIME AND SAMPLING. Keisuke Izawa (Purdue Univ., Lafayette, Ind.) and Lynn E. Weaver (Univ. of Arizona, Tucson). Applications and Ind. No. 42, 49-54 (1959) May.

The problem of analysis and design of relay-type feedback control systems with dead time and sampling in the time domain is analyzed by the phase plane method. By means of the phase plane, relay-type control action coupled with sampling and holding action can be considered as a varying dead time in the time domain. In the phase plane there exists a limit band, the exact boundaries of which can be predicted and within which all possible limit cycles lie. Control of this band makes possible control of the maximum and minimum amplitudes and the period of oscillation of the output variable. The effect of the minor loop feedback on the limit band is discussed. (C.J.G.)

5352

METHOD FOR PHOTOGRAPHIC IDENTIFICATION OF MICROSCOPIC RADIOACTIVE PARTICLES. J. Sisefsky (Research Inst. of National Defence, Stockholm). Brit. J. Appl. Phys. 10, 526-9(1959) Dec.

A method is described for identification and microscopy of small radioactive particles mixed with a large amount of inactive ones. The particles are prepared on a celluloid coating on a glass plate. The plate is coated with nuclear emulsion in gel form which is reversal developed in situ leaving the active particles visible, in the centers of clear circular spots against a brown transparent background. (auth)

5353

USE OF SECONDARY ELECTRONS TO IMPROVE EXTRACTION AND FOCUSING OF A BEAM OF LITHIUM IONS (Li^+) FROM A SOLID SOURCE. Jean-Pierre Poffe (Sorbonne, Paris and Institut Interuniversitaire des Sciences Nucléaires, Brussels). Compt. rend. 249, 1220-2(1959) Dec. 9. (In French)

A determination was made of the effects of secondary electrons on the extraction and focusing of a Li^+ beam by the thermionic effect, the beam operating in the continuous region. An improvement of 20 to 40% according

to the grid potential was shown for the secondary electron effect. It was thought that slow secondary electrons contribute, with ionization electrons, to total neutralization of the ionic beam. The more-energetic secondary electrons traverse the beam and act principally in the region where this velocity is cancelled by the repulsive effect of the grid potential. An accompanying emission increase was noted when the grid admitted secondary electrons. (T.R.H.)

5354

OPERATING CHARACTERISTICS OF IONIZATION CHAMBERS FILLED WITH LIQUID HEXANE. Daniel Blanc, Gilbert Giron, Jacques Mathieu, Monique Ponsan, and Théophile Pujol (Centre de Physique Nucleaire, Toulouse, France). Compt. rend. 249, 2546-8(1959) Dec. 9. (In French)

Measurements were made, at laboratory temperature, of the current flowing in liquid hexane-filled ionization chambers during α and γ irradiation. The Jaffe theory applies when the electric field is below 12,000 v/cm. Above this an amplification effect is produced in the detector analogous to that for gas-filled chambers. (tr-auth)

5355

MEASURING MEGA-AMPERE TRANSIENT CURRENTS. Clelland D. Nail (Univ. of Calif., Livermore). Control Eng. 7, No. 1, 153-5(1960) Jan.

The design of a circuit for measuring mega-ampere transient currents utilizes a changing magnetic field which surrounds a conductor through which a changing current is flowing. The current, produced by a capacitor bank, can be measured by a toroidal pickup coil inserted into the coaxial line. Expressions for the calibration of such a circuit are given. (C.J.G.)

5356

CORRECTION FACTORS FOR THE ABSOLUTE DOSIMETRY OF PLANE BETA SOURCES BY A GEIGER-MÜLLER COUNTER. Jiřina Matoušková (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 154-70(1958). (In Russian)

Expressions are given for the self-absorption factors of homogeneous plane sources with a consideration of the effects of the diaphragm thickness on the geometric effectiveness of plane sources. The relationship of interaction between the source and the limited diaphragm is investigated, which permits a simplification of the calculations on the efficiency of the registration. (tr-auth)

5357

THE RESOLUTION OF PHOTOMULTIPLIERS IN SCINTILLATION SPECTROMETERS. Jiří Kopecký and Josef Kajfosz (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 171-80(1958). (In English)

The resolution of scintillation spectrometers for γ rays is influenced by several factors. A method for separately judging the individual factors is discussed. The influence of statistical processes in the photomultiplier and the possibility of improving the resolution of the scintillation spectrometer by choosing the most suitable photomultiplier and its working parameters are particularly studied. (auth)

5358

STRAY FIELDS OF CONICAL POLE PIECES. Ivan Řezanka (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 266-8 (1959). (In Russian)

A magnetic field of variable plane symmetry in reverse proportion to the distance from the field axis is suggested for the analysis of charged particle motions. The field is constructed by means of conical pole pieces in the shape of straight cones with a common axis and common apex. The field is adapted to a prizmatic spectrometer. By selecting corresponding variables it is possible to reduce the problem of scattering to the solution of a single plane problem. (R.V.J.)

5359

THE EFFICIENCY OF A γ-RAY SUMMATION SPECTROMETER. Jiří Kopecký and Josef Kajfosz (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 268-9(1959). (In English)

The dependence of the efficiency of the γ summation spectrometer, described previously (Czechoslov. J. Phys. 8, 574(1958)), on the energy is calculated. The results show that the efficiency decreases with increasing energy up to about 3.5 Mev. At higher energy it again increases. The spectrometer is sufficiently efficient in the energy range from 0.1 to 10 Mev. (J.S.R.)

5360

THE INFLUENCE OF THE EMISSION PROPERTIES OF AN ANODE ON THE CHARACTERISTICS OF GM-COUNTERS. Radko Seidl (Inst. of Technical Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 517-23(1959). (In Russian).

The hitherto unknown mechanism of the production of false pulses is investigated, and its influence on the characteristics of counters is discussed. (auth)

5361

NEW SCHEMES FOR A HODOSCOPE. I. NEON CELL FOR HADOSCOPES WITH SELF-QUENCHING COUNTERS. G. S. Akopyan, G. A. Marikyan, and V. M. Khartonov (Inst. of Physics, Academy of Sciences, Armyan. SSR). Izvest. Akad. Nauk Armyan. S.S.R., Ser. Fiz.-Mat.. Nauk 12, No. 1, 85-91(1959). (In Russian)

Descriptions are given of a new neon cell with improved parameters. Tests of the suggested scheme in a hodoscope with 100 to 200 cells indicate a resolving power of $\tau = 15$ μsec. The supply scheme for self-quenching G-M counters and the coincidence and anticoincidence schemes are plotted and discussed. (R.V.J.)

5362

PERFORMANCE OF GERMANIUM AND SILICON SURFACE BARRIER DIODES AS ALPHA-PARTICLE SPECTROMETERS. James W. Mayer (Purdue Univ., Lafayette, Ind.). J. Appl. Phys. 30, 1937-44(1959) Dec.

The characteristics of a germanium surface barrier diode operated at room temperature make it particularly useful as an alpha-particle spectrometer. The small size, stability, energy resolution, and relative insensitivity to β and γ radiation of the units suggest applications in medical and nuclear research. Studies were made on Au-Ge and Au-Si surface barriers with a barrier width ($\cong 1$ μ) less than the range of the incident alpha particles. In the germanium units, the pulse-height response to alpha particles increased linearly with energy up to 7.5 Mev and then increased monotonically but more slowly as the energy rose to 12 Mev. In silicon the deviation from linearity occurred around 6 Mev. The observed linearity between pulse height and energy depends simply on the fact that the number of carriers excited is proportional to the particle energy and that the time for the carriers to be collected at the barrier is less than the circuit time constant. The general theory of the transient response of the diode was developed and the calculated response compared with the observed behavior. The observed values of the energy required to create a hole-electron pair, measured over the energy range of linear response of the junction, were $\epsilon_{(Ge)} = 2.96 \pm 0.1$ ev and $\epsilon_{(Si)} = 3.9 \pm 0.3$ ev. (auth)

5363

NUCLEAR RESONANCE ABSORPTION CIRCUIT. F. N. H. Robinson (Clarendon Lab., Oxford). J. Sci. Instr. 36, 481-7(1959) Dec.

The basic designs of nuclear resonance absorption circuits are described. The design features of two circuits are given. The first circuit uses a pentode of mutual conductance 16.5 ma/v with input and output capacities of 11.5 and 3.5 pF and a limiter with low input capacity of 4 pF. The choke (4 mh) is astatically wound. The circuit is designed to give levels between 10 and 200 mv at frequencies of 20 to 60 Mc with coarse tuning of the interstage circuit. The second circuit employs a three-stage amplifier and pentodes and a limiter of the type used in the first circuit. This circuit is designed to give levels between 1 and 250 mv at 200 kc to 20 Mc with no tuning adjustments. The choke is 10 mh and again astatically wound. The advantages of the circuits are discussed. (C.J.G.)

5364

LEAK DETECTION. W. Steckelmacher (Edwards High Vacuum Ltd., [Sussex, Eng.]). Nuclear Eng. 4, 450-3(1959) Dec.

Methods of leak detection of both the vacuum test and positive pressure test type are reviewed. The application, advantages, and operating principle of each type are discussed. (C.J.G.)

5365

A LONGITUDINAL β-SPECTROMETER WITH COMPENSATED SPHERICAL ABERRATION. K. A. Dolmatova and V. M. Kelman (Academy of Science U.S.S.R., Leningrad). Nuclear Instr. and Methods 5, 269-79(1959) Nov. (In English)

A new method for the compensation of spherical aberration in a longitudinal beta-ray spectrometer is described. On the homogeneous magnetic field is superimposed a correcting field generated by means of a special coil system placed inside the spectrometer. Theoretical and experimental investigations of the focussing properties are given and it is shown that the compensation coils give a considerable reduction of the spherical aberration. With a 1×1 mm^2 source a relative halfwidth of 1.4% and an effective transmission of 5.2% was obtained. At a resolution of 1.9% the effective transmission was found to be 6.5%. A Ø5 mm source gave a resolution of 3%. (auth)

5366

1000-CHANNEL TIME-OF-FLIGHT SELECTOR. J. Apter, J. Roussel, J. M. Tissier, and R. Wahl (Nucléaire Société Intertechnique, Versailles, France). Nuclear Instr. and Methods 5, 300-11(1959) Nov. (In French)

The design and performance are given for a 1000-channel time-of-flight analyzer with magnetic core memory for data storage. Neutrons of a given energy may be statistically counted and the data stored in the memory. The spectrum can be seen in a cathode ray tube and then traduced channel by channel. Three separate inputs are available, permitting simultaneous use with three detectors. (D.E.B.)

5367

INSTRUMENT FOR RAPIDLY COUNTING EXTENDED RADIATION SOURCES. K. H. Lauterjung and W. Gruhle (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Nuclear Instr. and Methods 5, 323-6(1959) Nov. (In German)

There are two possibilities of recording the distribution of radiation intensity in an extended area. The first has a good resolution of space, but requires a recording time too long for rapid changes, while the second records with good resolution of time but with a restricted one of space. The new method has a good resolution both of time and of space. The main feature is the use of the propagation speed of GM-counter discharge. The area under inspection is covered by ten counters, each of which is sensitive for 1 msec. The primary pulse of radiation hitting the sensitive counter starts the recording device and the arrival of the discharge in a short probe counter triggers a CRO display which gives a mapping of the radiation. (auth)

5368

NUCLEAR PLATE CAMERAS FOR THE MEASUREMENT OF PROTON ENERGIES EMITTED FROM A TOROIDAL DISCHARGE IN DEUTERIUM. W. M. Jones, A. C. L. Barnard, K. M. Young, E. D. Taylor, D. G. Waters, and H. B. Mundy (Associated Electrical Industries Ltd., Aldermaston, Berks, Eng.). Nuclear Instr. and Methods 5, 327-31(1959) Nov. (In English)

Two types of nuclear plate camera used for measurement of proton energies emitted from a toroidal discharge in deuterium in SCEPTRE are discussed. One of these records energies of protons emitted normal to the discharge axis, while the other records protons emitted at about 45° or 135° to the direction of positive gas current along the axis. A later model of the second type which records at both angles simultaneously, is also described. The size of slot in the wall of the discharge vessel necessitates that the second type of camera should be very small, and should be placed close to the wall. Measures to prevent damage to the nuclear plate by shock waves or overheating are given. The energy resolution of the cameras was found using a monoenergetic beam of protons from the A.E.I. electrostatic generator. (auth)

5369

SIMPLE CORE SCALING CIRCUITS. J. C. Barton (Northern Polytechnic, London). Nuclear Instr. and Methods 5, 332-4(1959) Nov. (In English)

A new type of core scaler is described which requires only one transistor per stage. Details are given of a scale of ten which operates from a 6-volt supply, consumes 1.5 mw at 1000 counts per seconds, and has a resolving time of 5 μsec. It is possible to obtain a resolving time of 1 μsec with a scale of two. These circuits are not critically dependent on component values. (auth)

5370

TRANSISTORIZED PORTABLE COUNTING-RATE METER. William W. Goldsworthy (Univ. of California, Berkeley). Nucleonics 18, No. 1, 92; 94; 96; 98-9(1960) Jan.

A transistorized, portable counting-rate meter, capable of detecting alpha, beta, gamma, or neutron radiation by means of interchangeable detector probes is described. Some advantages of this multipurpose detector are its versatility, compactness (weighs under 4 pounds and measures $4 \times 4 \times 9$ in.), ease of servicing (standard parts are used), and low battery drain (the battery lasts more than two weeks under continuous operation or up to a year under normal intermittent operation). A schematic of the instrument is presented in two parts—the amplifier circuit and the metering circuit. Uses of the proportional and G-M probes were discussed. (B.O.G.)

5371

BACKGROUND VS. EFFICIENCY IN LIQUID SCINTILLATORS. Floyd R. Domer and F. Newton Hayes (Los Alamos Scientific Lab., N. Mex.). Nucleonics 18, No. 1, 100(1960) Jan.

A correlation between background and counting efficiency in liquid scintillators was made as a part of a gross metabolic study of a C^{14}-labeled drug in rats. The relationship

between counting efficiency and background is not linear. This is caused by the changing chemistry and quenching which alters the detection efficiencies of different samples. (B.O.G.)

5372

THE DESIGN, TECHNOLOGY, AND PROPERTIES OF BORON TRIFLUORIDE PROPORTIONAL COUNTERS. Adam Kazimierski (Inst. of Nuclear Research, Warsaw). Nukleonika 4, 199-220(1959). (In Polish)

The development and progress in the production of BF_3 counters is discussed. The basic principles of operation of slow neutron counters using the (n,α) reaction with B^{10} are given. Descriptions are given of the design, technology, and filling techniques, based on high vacuum technique, which were used in the production of a number of types of counter of various dimensions, and gave good and reproducible counter characteristics. A diagram of the electronic apparatus is given and the influence of its parameters on the electrical characteristics of the counters is discussed. The pulse amplitude distributions measured for various types of counters are given. From these data it is seen that the spread in pulse size is considerably increased for large gas amplifications ($A \geq 500$) and for reduced differentiation time constant of the electronic circuits ($Tr \leq 0.1$). (auth)

5373

A SIMPLE PHOTOMETER SUITABLE FOR MEASURING THE BLACKENING OF FILMS IN PHOTOGRAPHIC DOSIMETRY. Jiří Kočí and Zdeněk Spurný (Ústav jaderného výzkumu ČSAV, Prague). Pracovní lékařství 11, 412-14 (1959). (In Czech.)

A special microphotometer for photographic dosimetry of ionizing radiation was constructed. The instrument has a very good differentiating ability, and it is accurate, strong, and cheap. It is very well suited for the rapid evaluation of protective film dosimeters at various working places such as Regional Hygiene and Epidemiological Stations, research institutes, and laboratories of industrial enterprises. (auth)

5374

4π COUNTER WITH DOUBLE ANTICOINCIDENCE CIRCUIT. F. Alba A., T. A. Bródy, and I. Castro V. (Instituto de Física, Universidad Nacional Autónoma de Mexico, Mexico City). Rev. mex. Fis. 8, 117-37(1959). (In Spanish)

A new type of connection of the two halves of a 4π gas-flow Geiger counter is presented, in which only pulses occurring in one half are counted, coincidences between the two halves caused by cosmic-ray background being eliminated. This way each half serves as coincidence-protection counter for the other, while contributing to the sample count. Backgrounds are down to about 25 ppm in a 4π lead shield, while counting efficiency remains practically equal to 100%. Micromicrocurie activities can be counted, using only very little equipment. (auth)

5375

GAS CHERENKOV COUNTER. M. Beneventano (Istituto Nazionale di Fisica Nucleare, Rome). p.103-6 of "Nuclear Electronics. I." (In French)

A Cherenkov counter was constructed to distinguish electrons from ions in experiments with the 1-Bev electron synchrotron being constructed at Frascati. To fulfill its purposes, the counter must have a yield very close to 100%. Preliminary measurements were made on the yield with cosmic muons. The data obtained indicate that there is a conversion yield for photons into photoelectrons of 1.1%. (J.S.R.)

5376

LUMINESCENT EFFECTS IN PHOTOMULTIPLIER TUBE FACES AND PLEXIGLAS ČERENKOV DETECTORS. Kinsey A. Anderson (State Univ. of Iowa, Iowa City). Rev. Sci. Instr. 30, 869-73(1959) Oct.

By means of 20 and 35 Mev proton beams obtained from the University of Minnesota Linac, luminescent effects in Plexiglas Cherenkov detectors were investigated. It was found that 1% of the protons entering the detector produced light pulses which overlapped the mu-meson Cherenkov light distribution. These light pulses correspond to energy losses in a sodium iodide crystal of mainly less than 20 kev. Luminescent effects in the glass face of the particular photomultiplier employed were also studied and found to be quite large. (auth)

5377

SMALL, LIGHTWEIGHT IONIZATION GAUGE CONTROL CIRCUIT. H. B. Benton (Goddard Space Flight Center, Washington, D. C.). Rev. Sci. Instr. 30, 887-8(1959) Oct.

A lightweight, compact thermionic ionization gage control is described which is simpler and more efficient than conventional units. Emission regulation is achieved by using a transistorized feedback amplifier to maintain constant emission current in the presence of variations in supply voltage and pressure. Ion current is measured from 10^{-8} to 10^{-4} amp, in a single range, using a Zener diode as a logarithmic element in the collector circuit. Two control units were successfully flown aboard the IGY Aerobee-Hi rocket NN3.14F. (auth)

5378

METHOD FOR RAPID DETERMINATION OF VACUUM OUTGASSING RATES. Ivory P. S. Fish (Raytheon Co., Burlington, Mass.). Rev. Sci. Instr. 30, 889-90(1959) Oct.

A method for the rapid determination of vacuum outgassing rates is described. Automatic range selection and automatic recording is used to accomplish this. Outgassing rates from 10^{-3} to 10^{-7} torr liter per second can be determined. (auth)

5379

PRINCIPLE OF A SEMICONDUCTOR MANOMETER IN THE PRESSURE RANGE OF 1 TO 10^{-6} mm Hg. M. Varićak and B. Saftić (Inst. of Physics and Rudjer Boskovic Inst., Zagreb, Yugoslavia). Rev. Sci. Instr. 30, 891-5(1959) Oct.

Experiments investigating the use of semiconductors for low-pressure measurements proved that thermistors give the best results. These experiments led to the construction of thermistor systems consisting of miniature thermistors fixed to thin metal foils. With these systems it is possible to measure pressure changes in the range of 1 to 10^{-6} mm Hg. The problem of temperature compensation is discussed and it is shown that in the case of thermistors this problem may be resolved by means of the voltage vs current characteristics. A detailed description of the apparatus, including the gauge head as well as the electric circuit and the calibration curves, is given. (auth)

5380

MOMENTUM ESTIMATE FROM MAGNETIC CURVATURE IN DISTORTED EMULSIONS. G. Bellettini (The Università, Rome) and Istituto Nazionale di Fisica Nucleare, Rome. Rev. Sci. Instr. 30, 899-901(1959) Oct.

Kim's analysis of the precision obtainable in momentum measurements from the curvature of the tracks in an emulsion placed in a pulsed magnetic field is furthered taking into account the distortion of the plates. Calcula-

tions show that one cannot hope to reach a decisive improvement from a pulsed magnetic field, if the distortion of the plates is not reduced somewhat below present-day values. The use of thicker emulsions is suggested as a possible way of improving the situation. (auth)

5381

OPTIMIZATION OF FRAME RATES FOR HIGH-SPEED PHOTOGRAPHY. Thomas P. Rona (Massachusetts Inst. of Tech., Cambridge) and Charles L. Feldman (Edgerton, Germeshausen and Grier, Inc., Boston). Rev. Sci. Instr. 30, 902-7(1959) Oct.

The numerical results obtained from high-speed photography are examined in order to determine the frame rate best suited to a given phenomenon. Procedures for optimum frame rate determination are shown for deterministic and random space-time functions with emphasis on error reduction in velocity measurements. Characteristics of the random errors of a typical high-speed camera are given. (auth)

5382

DOUBLE CRYSTAL X-RAY MONOCHROMATOR-COLLIMATOR. Robert S. Williamson and I. Fankuchen (Polytechnic Inst. of Brooklyn). Rev. Sci. Instr. 30, 908-10(1959) Oct.

A pair of crystals mounted so as to have perpendicular planes of incidence is used to produce a collimated monochromatic x-ray beam. The design permits simple adjustment of the final beam inclination. (auth)

5383

LARGE CRYSTAL TOTAL ABSORPTION SPECTROMETER. S. Standil and W. D. Loveridge (Univ. of Manitoba, Winnipeg, Can.). Rev. Sci. Instr. 30, 931-3(1959) Oct.

A total absorption scintillation spectrometer was built primarily for the study of the neutral component of cosmic radiation. The high energies involved necessitate a large NaI(Tl) crystal (~70 lb) completely surrounded by an efficient anticoincidence shield. The design and performance of this instrument are discussed. (auth)

5384

MONITOR-SYNCHRONIZER FOR ROTATING MIRROR CAMERAS. W. B. Ferrand and G. E. Gagnon (Stanford Research Inst., Menlo Park, Calif.). Rev. Sci. Instr. 30, 939-42(1959) Oct.

Rotating mirror cameras greatly assist in gathering data associated with the detonation and the attendant shock waves in the study of explosive phenomena. The monitor-synchronizer is used to synchronize the detonation initiation and the angular position of the mirror for proper film registration and also to monitor the rotational speed of the mirror. A schematic diagram of the instrument and component performance is presented. (B.O.G.)

5385

PRESSURE SENSING PROBES FOR DETECTING SHOCK WAVES. Adolph B. Amster and Raymond L. Beauregard (U. S. Naval Ordnance Lab., White Oak, Md.). Rev. Sci. Instr. 30, 942(1959) Oct.

The ionization probe is discussed in connection with the measurement of the velocity of reactive shocks in explosive materials. Static tests show that the thin wall in the present configuration will collapse at ~12,000 psi. The estimated response time of the probe is of the order 0.1 μ sec. The attenuation of shock velocity in propellants and in inert materials such as Lucite was measured. (B.O.G.)

5386

50-Mc DISCRIMINATOR-SCALER. M. Gettner and W. Selove (Univ. of Pennsylvania, Philadelphia). Rev. Sci. Instr. 30, 942-3(1959) Oct.

A procedure which gives a recovery time which corresponds to a very short resolving time was built into a 50-Mc discriminator-scaler. In applying the principle in a circuit, transistors were used as switching elements and a resolving time of less than 20×10^{-9} sec was obtained. A diagram of the instrument and component performance is presented. (B.O.G.)

5387

HIGH-SENSITIVITY PRESSURE GAUGE COUPLING TWO SPOON GAUGES. R. R. Monchamp, E. Bannister, and F. A. Cotton (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 30, 945-6(1959) Oct.

A somewhat different arrangement of spoon or sickle gages is discussed which is more easily constructed. The sensitivity of the modified arrangement is about 3 whereas for the unmodified arrangement it is about 0.01 to 0.1 (defined as mm deflection per mm of Hg pressure differential). (B.O.G.)

5388

LOGARITHMIC CHARACTERISTIC OF TRIODE ELECTROMETER CIRCUITS. Stanley K. Chao (Baird-Atomic, Inc., Cambridge, Mass.). Rev. Sci. Instr. 30, 1087-92 (1959) Dec.

The triode-connected 5889 electrometer tube was found to be useful as a logarithmic element over a grid current range of 10^{-14} to 10^{-6} amp. The relationship of plate current to grid current was carefully studied over a span of three and one-half decades as a function of the plate supply potential, the plate circuit load resistance, and the filament voltage. A circuit was developed for use in an ionization chamber survey instrument. Most 5889 tubes will work in the circuit after a 150-hr aging period. Over-all accuracy of ±10% of the reading is feasible. (auth)

5389

MASS SPECTROMETER LEAK DETECTOR WITH IMPROVED SENSITIVITY. John L. Peters (Crosby-Teletronics Corp., Syosset, N. Y.). Rev. Sci. Instr. 30, 1093-5(1959) Dec.

A new type of mass spectrometer leak detector is described which has a sensitivity for helium of 10^{-13} standard cc/sec with a signal-to-noise ratio of unity. Operating pressure is in the 10^{-5} to 10^{-6} mm Hg range, time for $\frac{2}{3}$ of final response is 2 sec or less, and operating characteristics are similar to present helium-sensitive mass spectrometer leak detectors. (auth)

5390

LINEARLY BIASED TRACK COUNTING IN CROSS-SECTION DETERMINATIONS. Frank S. Crawford, Jr. (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 1096-7(1959) Dec.

In determining the average number $\bar{n}$ of tracks per bubble chamber picture, for purposes of determining cross sections, tracks in randomly selected pictures are usually counted. An alternative procedure is described in which the pictures are not selected at random, but are those which contain the "interesting events." The average of $1/n$ over this "linearly biased" sample equals $1/\bar{n}$, where $\bar{n}$ is the desired average over a random sample. (auth)

5391

SIMPLIFIED LOGARITHMIC RADIATION METER USING NOISE. Charles Erwin Cohn (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 30, 1097-9(1959) Dec.

A logarithmic radiation meter was developed which uses

an a-c-coupled logarithmic voltmeter to measure the random noise from a photomultiplier detector. A range of four decades was obtained. (auth)

5392

PULSE-HEIGHT ANALYZER FOR NEURO-PHYSIOLOGICAL APPLICATIONS. R. M. Littauer and C. Walcott (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr. 30, 1102-6(1959) Dec.

A five-channel differential pulse-height analyzer is described, designed specifically for the observation of action potentials in nerve fibers. By measurement of the pulse amplitudes, it is possible to follow the activity of one or more single nerve fibers continuously. (auth)

5393

TRANSISTORIZED DISTRIBUTED AMPLIFIER. Charles W. McMullen (Northwestern Univ., Evanston, Ill.). Rev. Sci. Instr. 30, 1109-13(1959) Dec.

Some analytical and experimental results are given for a transistorized distributed amplifier using the common emitter configuration. The characteristic impedances of the base and collector transmission lines are both 43.4Ω. A 4-section amplifier stage yields a mid-frequency gain of 5.1 db and an upper half-power frequency of 290 Mc. The low-frequency response is reasonably constant down to 10 cps. (auth)

5394

MAGNETIC SUSCEPTIBILITY BALANCE USING A NULL TECHNIQUE. J. R. Singer (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 1123-4(1959) Dec.

A very sensitive magnetic susceptibility balance is described with the characteristic of providing a null reading over all field strengths whenever the sample is purely paramagnetic. The balance is used mainly for single crystal measurements of susceptibility at high and low temperatures. Any ferromagnetic impurity shows as a null deviation as the magnetic field strength is altered. The degree of unbalance obtained is readily used to subtract out the ferromagnetic impurity from the paramagnetic or antiferromagnetic components of the susceptibility. (auth)

5395

NEW LIQUID SCINTILLANT. H. A. Miranda, Jr. and H. Schimmel (Columbia Univ., Hudson Labs., Dobbs Ferry, N. Y.). Rev. Sci. Instr. 30, 1128-9(1959) Dec.

The preparation of a scintillant consisting of 4 g of 2,5-diphenyloxazole and 100 g naphthalene per liter of Dow Corning Silicone-555 fluid is given. Scintillation efficiency is compared with that of various other scintillants. (C.J.G.)

5396

GLASS SCINTILLATORS FOR NEUTRON DETECTION. L. M. Bollinger and G. E. Thomas (Argonne National Lab., Lemont, Ill.), and R. G. Ginther (Naval Research Lab., Washington, D. C.). Rev. Sci. Instr. 30, 1135-6(1956) Dec.

The characteristics for neutron detection of some clear boron-containing glass scintillators are discussed. The pulse-height response of the glasses GL-127 and GI-55 to thermal neutron capture is given. Tests on small samples of the two glasses indicate they can be used as detectors for slow neutrons. (C.J.G.)

5397

USE OF RADIATION EQUIPMENT FOR PLOW-LAYER DENSITY AND MOISTURE. R. E. Phillips, C. R. Jensen, and Don Kirkham (Iowa State Univ., Iowa City). Soil Sci. 89, 2-7(1960) Jan.

Radiation probes were found to be quicker and give approximately the same precision as core sampling for determinations of the approximate plow-layer density and moisture content of soil. Results of two field experiments are reported. (C.H.)

5398

A TRANSISTORIZED MAGNETIC-CORE DECIMAL SCALER. Guglielmo Giannelli (Centro Nazionale di Ricerche Nucleari, Ispra, Italy). Strumentazione e automazione, No. 6, 279-80(1959) June. (In Italian)

A description is given of a transistorized blocking oscillator with a saturated ferromagnetic core and used to produce voltage pulses of constant area. These pulses control a special circuit made up of an inductor with a central coil wound on plates in a rectangular hysteresis loop which controls a suitable binary circuit in which the saturated transistor conducts; the binary circuit voltage is supplied by commutation of the inductor. With 5 pulses going through one side of the hysteresis loop and the other 5 returning to the initial condition along the other side an output pulse is obtained. One must examine the condition of functioning of the core to obtain the division through ten. (tr-auth)

5399

TRANSITION RADIATION IN A WAVE GUIDE. K. A. Barsukov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1106-9(1959) Oct. (In Russian)

The radiation which arises in a wave guide when a charged particle passes through the boundary between two media is considered. It is shown that at ultrarelativistic charge velocities the radiation is mainly directed in the forward direction and its magnitude is proportional to the energy of the particle. Formulas are derived for the total energy of the radiation and its spectral distribution. (auth)

5400

L'ELECTRONIQUE NUCLEAIRE. I. COMPTES RENDUS DU "COLLOQUE INTERNATIONAL SUR L'ELECTRONIQUE NUCLEAIRE" ORGANISE PAR LA SOCIETE FRANCAISE DES RADIOELECTRICIENS, PARIS, 1958. (Nuclear Electronics. I. Proceedings of the International Symposium on Nuclear Electronics Organized by the French Society of Radioelectricians, Paris, 1958). Vienna, International Atomic Energy Agency, 1959. 45p.

The proceedings of the symposium on nuclear electronics held in Paris in 1958 are presented. The session subjects were scintillation radiation detectors, ionization radiation detectors and gamma spectrometers, pulse technique: fast electronics, pulse technique: classical electronics, reactor control: measurements, reactor control: simulation, equipment for prospection and protection, centralization and exploitation of results, and transistorized equipment, standardization, and components. Separate abstracts have been prepared on each paper. (J.S.R.)

5401

THE SCINTILLATION COUNTER. G. A. Morton (RCA Labs., Princeton, N. J.). p.3-13 of "Nuclear Electronics. I." (In English)

A general review is given of the characteristics of scintillation counters. The scintillators and photomultipliers widely used in the United States are tabulated. The sensitivity, energy discrimination, and time resolution of scintillation detectors are examined in some detail. (J.S.R.)

5402

THE PROCESSES INVOLVED IN THE IMPROVEMENT OF PLASTIC SCINTILLATORS. F. H. Brown, M. Furst, and H. Kallmann (New York Univ.). p.15-26 of "Nuclear Electronics. I." (In English)

The methods used in liquid scintillators to enhance the fluorescence efficiency and to extend their application by the incorporation of various materials are applied to plastic scintillators. Polystyrene and polymethylmethacrylate were used as the bulk solvents in the studies. The energy transfer and quenching obtained for various solutes were determined, and the probable mechanisms are discussed. The results show that it is possible to prepare efficient scintillators from polystyrene and polymethylmethacrylate. (J.S.R.)

5403

THE VARIATION OF PHOSPHOR DECAY TIME WITH SPECIFIC IONISATION AND ITS APPLICATIONS. R. B. Owen (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.27-35 of "Nuclear Electronics. I." (In English)

The possibility of distinguishing between scintillations produced in phosphors by particles of differing specific ionization was investigated. Photographs of individual scintillation pulses produced by fast neutron and gamma ray excitation were obtained. The shapes of the pulses obtained for several organic phosphors are shown. The circuit for a decay time discriminating system used for obtaining the neutron pulses only is given. When pulses from inorganic phosphors such as NaI-Tl or CsI-Tl are photographed in the same way as from organic phosphors, the peak-height pulses for a given total charge are lower under electron excitation than under alpha-particle excitation. The pulse shapes obtained are given for NaI(Tl). (J.S.R.)

5404

MECHANISM OF THE SCINTILLATION PHENOMENON IN ALKALI HALIDE PHOSPHORS. W. J. Van Sciver (Levinthal Electronic Products, Inc., Palo Alto, Calif.). p.37-43 of "Nuclear Electronics. I." (In English)

Gamma radiation interacts with the nuclei or electrons of alkali halide crystals to produce high-energy electrons. These electrons dissipate their energy to the crystal matrix, and the energy is then conveyed to luminescent centers, which convert it to light. A preliminary model is presented which describes the nature of the luminescent centers in NaI-Tl crystals and the mechanism of energy transfer from the crystal matrix to these luminescent centers. It is concluded that the principal luminescent centers are caused by the substitution of the Tl^+ ion for a Na^+ ion. The transitions resulting in luminescence are discussed. The possible energy carriers in the crystals are the electrons in the conduction band (and holes in the "filled" band), excitons, and ultraviolet photons. Each is examined in some detail. (J.S.R.)

5405

ENRICHED BORON SCINTILLATORS FOR SLOW NEUTRONS. H. Durand and P. Habert. p.45-52 of "Nuclear Electronics. I." (In French)

The efficiency of a boron glass obtained by the partial dehydration of boric acid was investigated using boron enriched to 92% in B^{10}. The glass was mixed with ZnS with the weight ZnS/H_3BO_3 equal to one. The absolute yield was investigated theoretically as a function of the enrichment and scintillator thickness. The experimental results confirm the theoretical hypotheses with the exception that the efficiency begins to decrease earlier than predicted. The counting plateau and the gamma discrimination were investigated as a function of the thickness, and the effects of notched supports on the counting efficiency were studied. The results of the studies showed that the use of enriched boron has definite advantages with a yield approximately 2 to 2.5 times higher than that obtained with natural boron. (J.S.R.)

5406

NEW STUDIES ON THE PHYSICAL PROPERTIES OF ORGANIC AND MINERAL SCINTILLATORS. L. Koch, Y. Koechlin, B. Mougin, and L. Treguer (Centre d'Etudes Nucléaires, Saclay, France). p.53-6 of "Nuclear Electronics. I." (In French)

The influence of temperature and mode of excitation on organic and mineral scintillators was investigated. Preliminary measurements have shown that the temperature coefficient of photomultipliers between +20 and −40°C is connected to the color of the incident light. It is attributed to the photocathode. The study of the temperature effects on the quantity of light emitted showed a negative temperature efficient. The ratio of light emitted for alpha particles and beta particles of the same energy was 0.13 for both anthracene and styrene polymer scintillators. The effects of the mode of excitation on the decay time was investigated for silver-activated zinc sulfide, NaI(Tl) and CsI(Tl), and the natural phosphor CaF_2. (J.S.R.)

5407

STUDY AND DEVELOPMENT OF A PHOTOMULTIPLIER FOR THE NANOSECOND RANGE. G. Pietri (Laboratoire D'Electronique et de Physique Appliquées, Paris). p.57-65 of "Nuclear Electronics. I." (In French)

The LEP type 204 photomultiplier, especially designed to operate in the nanosecond range, is described. It is capable of delivering instantaneous currents of approximately one ampere and maintaining a linear relationship between incident light and output current. The cathode yield, the collection efficiency, and the multiplication power are designed to handle high current peaks. The determination of the inlet optics is governed by the requirement of good space and time focusing. The front of the anodic pulse rise is established in a finite time. The 204 photomultiplier should deliver, for a photoelectron emitted by the cathode, an anodic pulse of the order of 20 ma established in approximately 2 nsec. For an illumination affecting the complete photocathode at once, pulses of a fraction of an ampere rise in 3 nsec. This should permit, in coincidence measurement, precision of the order of 10^{-10} sec. (J.S.R.)

5408

MEASUREMENT OF THE RESPONSE RAPIDITY OF THE L. E. P. TYPE 204 PHOTOMULTIPLIER. Y. Koechlin (Centre d'Etudes Nucléaires, Saclay, France). p.67-72 of "Nuclear Electronics. I." (In French)

The variations of isochronism of the L.E.P. type 204 photomultiplier were measured and the contribution of the inlet optics and of the multiplier to these variations was defined. The experimental arrangement is described in detail. Measurements on the multiplier gave 2 μsec for feed voltages of 3000 v total. The variations caused by the inlet optics were not measurable. (J.S.R.)

5409

CONTRIBUTION TO THE STUDY OF THE CHARACTERISTICS OF PHOTOMULTIPLIERS. R. Chery and A. Perrin (Institut de Physique Nucléaire, Lyon). p.73-8 of "Nuclear Electronics. I." (In French)

As the functioning of a photomultiplier implies the operation of a number of essentially statistical processes, characteristics defining the statistical nature of the formation of the current pulse of a photomultiplier were studied on a relatively new French photomultiplier, the 53 AVP. The spectra of a single electron were determined for feed voltages of 1700, 1725, and 1750 v. The curves

showed an increase of the relative number of large pulses with the interdynode voltage. An analysis of the tube gain and of the stage gain indicated that the modification of the curve can be attributed to a decrease of the variation of the stage gain with the voltage. The cathode homogeneity was measured and inhomogeneities of 10 to 25% were found. The variation in the transit time of electrons from cathode to anode was determined. Variations of the order of 3 to 4 mμsec were found. (J.S.R.)

5410

THE IONIZATION DETECTORS. U. Facchini (Centro Informazioni Studi Esperienze, Milan). p.83-102 of "Nuclear Electronics. I." (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15288.

5411

GAS ČERENKOV COUNTERS. John H. Atkinson and Victor Perez-Mendez (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 864-8(1959) Oct.

A gas Cherenkov counter is described which is suitable for charged-particle detection in the Bev region (β from 0.980 to 0.999). Calibrations of the counting efficiency are included along with a table of indices of refraction of suitable gases. The use of this counter as a threshold detector to discriminate between elastic and inelastic pions in the momentum range of 1 to 2 Bev/c is discussed. Use of the counter to differentiate between charged particles of different mass in a momentum-analyzed beam is also considered. (auth)

5412

A GAMMA RAY SPECTROMETER FOR ENERGIES UP TO 1 Gev. M. Beneventano, U. Pellegrini, B. Rispoli, G. C. Sacerdoti, P. G. Sona, and R. Toschi (Comitato Nazionale per le Ricerche Nucleari, Milan). p.107-16 of "Nuclear Electronics. I." (In English)

A pair spectrometer for energies up to 1 Bev was designed and is being constructed at the Italian National Laboratory. The magnet, target for conversion of photons into electron pairs, scintillation counters, and associated electronic equipment are briefly described. (J.S.R.)

5413

A MULTI-CHANNEL GAMMA-RAY SPECTROMETER WITH AUTOMATIC COMPTON OR BACKGROUND SUBTRACTION. D. M. C. Thomas (Admiralty Research Lab., Teddington, Middx., Eng.) and W. J. Callow (National Physical Lab., Teddington, Middx., Eng.). p.117-26 of "Nuclear Electronics. I." (In English)

A 93-channel gamma spectrometer with automatic Compton or background subtraction is described. The design considerations used in the construction of the instrument are briefly indicated, and the instrument itself is described in some detail. The spectrometer uses a NaI (Tl) crystal and for Compton subtraction an anthracene crystal. The analog to time converter is of the conventional Hutchinson Scarrott type. A fast lower level discriminator was constructed to enable the sorting circuits to handle delay line shaped pulses. Performance tests showed that the drift of the analyzer from cold is approximately one channel and after a warm-up period of 30 min it is less than one channel per day. Typical spectra obtained with the instrument are shown. (J.S.R.)

5414

THE SUM-COINCIDENCE METHOD AND ITS APPLICATION TO GAMMA-RAY SCINTILLATION SPECTROSCOPY. A. M. Hoogenboom (Rijksuniversiteit, Utrecht). p.127-36 of "Nuclear Electronics. I." (In English)

A new type of scintillation spectrometer based on the sum-coincidence method is described which is especially suited to measure γ-γ coincidence spectra and γ-γ angular correlations. It has good resolution and a relatively high efficiency for both low and medium gamma energies. Measurements made on Co^{60}, Na^{22}, and the 622 and 500 kev resonances of the $Si^{30}(p,\gamma)P^{31}$ reaction are discussed. The applicability of the method to angular correlation measurements is shown. (J.S.R.)

5415

UTILIZATION OF SEMICONDUCTORS AS DETECTORS OF NUCLEAR RADIATIONS. R. Bomal, L. Koch, Nguyen Van Dong, and C. Schneider (Centre d'Etudes Nucléaires, Saclay, France). p.137-49 of "Nuclear Electronics. I." (In French)

Because of the extreme sensitivity of semiconductors to radiations, studies were made on the application of semiconductors to the detection of nuclear radiation and to the direct transformation of nuclear energy to electrical energy. N-P junctions in germanium or silicon were used in the investigations. The electronic characteristics of semiconductors are briefly reviewed. Experiments were made on the detection of alpha particles, beta particles, gamma rays, and thermal neutrons. The results indicated that semiconductors have great future potential as radiation detectors and as transformers of nuclear energy to electrical energy. (J.S.R.)

5416

SCINTILLATION IN NOBLE GASES AND THEIR MIXTURES. L. Koch (Centre d'Etudes Nucléaires, Saclay, France). p. 151-62 of "Nuclear Electronics. I." (In French)

The scintillations produced in noble gases by charged nuclear particles were studied using Ar, Kr, Xe, He, N_2, mixtures of He and N_2, and Ar and N_2 at pressures usually of 740 mm Hg. In a study of the scintillation spectra and yield, rays from impurities of mercury and nitrogen appeared with mercury concentrations of less than 1 ppm and with nitrogen concentrations of 10 ppm. For pure gases the most intense rays were in the near ultraviolet. The variation of the pulse amplitude as a function of the nitrogen concentration in argon and helium is shown. The time constants for the scintillation decay were measured as a function of impurities and pressure. The emission of light following the passage of a charged particle is independent of the particle mass and is proportional to the energy transferred to the gas. Gamma rays have a negligible effect on the scintillations. The energy resolution obtainable in the detection of thermal and fast neutrons is discussed. (J.S.R.)

5417

FAST ELECTRONICS IN HIGH-ENERGY PHYSICS. Clyde Wiegand (Univ. of California, Berkeley). p. 169-76 of "Nuclear Electronics. I." (In English)

A brief survey is made of fast electronics in the field of high-energy physics. The present status of scintillation counters and Cherenkov detectors is discussed. The future developments needed by physicists in this area are indicated. (J.S.R.)

5418

A NANOSECOND VERNIER TIME ANALYZER. C. Cottini, E. Gatti, and F. Vaghi (Centro Informazione Studi Esperienze, Milan). p. 177-83 of "Nuclear Electronics. I." (In English)

The design and performance of a nanosecond vernier time analyzer are discussed. A block diagram is given of the instrument, and the slow coincidence, resonance, and time-to-height converter circuits are presented. Typical curves obtained with the instrument are shown. (J.S.R.)

5419

A FAST TRIGGER CIRCUIT. F. J. M. Farley (European Council for Nuclear Research, Geneva). p. 185-7 of "Nuclear Electronics. I." (In English)

A fast trigger circuit which forms part of a flexible four-channel coincidence-anticoincidence box used for mixing signals at medium speed is presented. (J.S.R.)

5420

A NEW METHOD OF PULSE TIMING APPLIED TO FAST COINCIDENCE WORK. Wolfgang Gruhle (Max Planck-Institut für Physik, Heidelberg, Ger.). p. 189-93 of "Nuclear Electronics. I." (In English)

In fast coincidence arrangements using slow scintillators, a compromise between noise background and coincidence efficiency is necessary when standard pulse generators are triggered to feed the coincidence stage with unit pulses of constant width and amplitude. A solution to this problem is proposed. With double differentiation (the first by an RC network and the second by a clipping cable) a pulse shape is obtained with a fixed crossing point exactly on a zero level common for all amplitudes. The crossover is used to trigger the coincidence pulse generator by the utilization of the Schmitt trigger circuit. The pulse shape of the input spectrum before and after differentiation is shown, and the circuit is given. The performance of the circuit was tested by plotting the delay over the various amplitudes of a test pulse generator. The results obtained with anthracene and NaI(Tl) crystals are shown. (J.S.R.)

5421

A NOVEL FAST COINCIDENCE CIRCUIT OF THE DICKE TYPE. W. F. Hornyak and H. Yoshiki (Univ. of Maryland, College Park and Princeton Univ., N. J.). p. 195-200 of "Nuclear Electronics. I." (In English)

The Dicke circuit was modified to permit its practical use with fast scintillation detectors. The operation of the Dicke circuit is reviewed briefly, and the modifications made to the original circuit are discussed. The modified circuit is presented, and a typical coincidence resolution curve obtained with it is shown. (J.S.R.)

5422

A FAST PHOTOMULTIPLIER AND COINCIDENCE SYSTEM FOR PRECISE TIME MEASUREMENTS. G. A. Morton and R. M. Matheson (RCA Labs., Princeton, N. J.). p. 201-8 of "Nuclear Electronics. I." (In English)

A photomultiplier tube designed to have time capabilities at least an order of magnitude better than conventional high speed tubes is described in detail, and the design principles involved in its construction are discussed. The multiplier structure, anode system, and photocathode-first-dynode electron optical system are illustrated. The nature of the time error from a multiplier is examined briefly. The operation of the new coincidence circuit of the photomultiplier is explained. (J.S.R)

5423

THE PULSE SAMPLING OSCILLOSCOPE. P. R. Orman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p. 209-16 of "Nuclear Electronics. I." (In English)

The pulse sampling technique, which can be used whenever the waveform to be displayed is recurrent, is discussed. The essentials of the pulse-sampling oscillograph are drawn schematically, and the operational principles are described. The mixer circuit, which is adequate for moderately high bandwidths, is given, with a discussion of the d-c connection, sensitivity, and disturbance of the circuit under test. The form of display obtainable with the sampling oscillograph is shown. (J.S.R.)

5424

TWO PULSE SCALERS WITH HIGH RESOLVING POWER. U. Pellegrini and B. Rispoli (Comitato Nazionale per le Ricerche Nucleari, Milan). p. 217-24 of "Nuclear Electronics. I." (In French)

Two pulse scalers, one with a scaling factor of 16 and the other with a factor of 5, are described. For the first instrument circuits are given for the binary scalers, pulse former, and coupling for the flip-flop. The second apparatus consists of a pulse former followed by a ring circuit with a scaling factor of 5 and then by a normal binary component. The ring is composed of a Philips EFP 60 with secondary emission. Circuits of the component parts are given. (J.S.R.)

5425

A FAST STORAGE SYSTEM FOR MULTICHANNEL PULSE HEIGHT ANALYSIS. G. F. Pieper (Yale Univ., New Haven). p.225-31 of "Nuclear Electronics. I." (In English)

In work with pulsed accelerators such as a betatron, an analyzer with a short dead time is necessary, and one with good amplitude resolution and stability would be desirable. Therefore the use of a fast storage system is proposed. The development of such systems is briefly reviewed. The principle of storage CRT operation is described, and a block diagram of the storage system designed is given. (J.S.R.)

5426

COINCIDENCE CIRCUIT WITH SHORT RESOLUTION TIME AND HIGH COUNTING RATE. J. C. Brisson, G. Valladas, and R. Van Zurk (Commissariat à l'Énergie Atomique, Paris). p. 233-41 of "Nuclear Electronics. I." (In French)

A coincidence circuit of short resolution time and high counting rate is described. The circuit consists of an input circuit which acts as limiter, amplifier, and mixer, a discrimination circuit with variable threshold, an output circuit which permits the obtention of negative and positive polarity, and a controlled feed +250 −150 v. The complete circuit is given, and its operation and performance are discussed. (J.S.R.)

5427

CONSTRUCTION OF A CHRONOTRON FOR FAST NEUTRON SPECTROMETRY. J. Duclos (Laboratoire de Physique Nucleaire de la Faculte des Sciences, Grenoble, France). p.243-7 of "Nuclear Electronics. I." (In French)

A chronotron having a resolution time of approximately 10^{-9} sec and being capable of receiving on one of its input paths 10^5 pulses/sec is described. The chronotron has a multiplication system which permits the division of the time scale into a large number of time intervals. The chronotron is a modification of the O'Neil chronotron. The interpolation and analysis circuits and the resolution time are discussed. A schematic diagram is given of the complete instrument. (J.S.R.)

5428

AMPLITUDE SELECTOR WITH LOW RESOLUTION TIME. M. Fiehrer and A. Pages (Centre d'Etudes Nucléaires,

Saclay, France). p. 249-58 of "Nuclear Electronics. I." (In French)

An amplitude selector with 10 channels defined by 11 discriminators is described. The principles of the selector are discussed with a consideration of the amplitude selection and the selector blocking. The circuits of the selector plate and the control plate are given. The performance of this selector is described briefly. (J.S.R.)

5429

PULSE GENERATOR BEGINNING WITH A ROSENBLUM COUNTER. J. Fleury (Centre d'Etudes Nucléaires, Grenoble, France). p. 259-62 of "Nuclear Electronics. I." (In French)

The Rosenblum counter, or spark counter, used in the development of this generator is a classical counter operating in air. The characteristics of the Rosenblum counter which suggest its use in the construction of a calibrated pulse generator are the short spark time and the considerable amplitude of the voltage pulse on the plate which permits the obtention of several tens of volts under very small impedance. The characteristics of the output pulse are described. The utilization of such a generator in the study of resolution times of fast coincidence systems and in the experimental determination of the transit time of photomultipliers is discussed. (J.S.R.)

5430

DIFFERENTIAL COINCIDENCE CIRCUIT. R. Meunier (Centre d'Etudes Nucléaires, Saclay, France). p. 263-8 of "Nuclear Electronics. I." (In French)

The design and performance of a differential coincidence circuit are discussed. The resolution time of the circuit is independent of the form, duration, and height of the pulses furnished by the photomultiplier. The circuit has a recovery time short enough to operate with the most intense particle beams from an accelerator. It can handle parasitic pulses of great amplitude. The operation of the circuit is described and experimental resolution curves are given. The detailed circuit is presented. (J.S.R.)

5431

REVIEW OF SOME RECENT CONTRIBUTIONS TO PULSE TECHNIQUES IN THE FIELD OF CLASSICAL NUCLEAR ELECTRONICS. Emilio Gatti (Centre Informazione Studi Esperienze, Milan). p. 273-80 of "Nuclear Electronics. I." (In English)

A general review is presented of the most recent developments in pulse techniques in classical nuclear electronics with consideration of pulse amplifiers, scalers, pulse timing, and information storage. (J.S.R.)

5432

A 200 CHANNEL PULSE HEIGHT ANALYZER. C. Cottini and E. Gatti (Centro Informazione Studi Esperienze, Milan). p. 281-6 of "Nuclear Electronics. I." (In English)

A 200-channel pulse height analyzer with transistorized magnetic core memory is described. The amplitude-to-time converter and the arithmetic unit are discussed. A block diagram is given of the complete analyzer, and the circuitry for components is presented. The performance is discussed. (J.S.R.)

5433

A WIDE PULSE HEIGHT DYNAMIC RANGE COINCIDENCE CIRCUIT FOR SLOW PHOSPHORS. René J. A. Levesque and William F. Hornyak (Univ. of Maryland, College Park). p. 287-90 of "Nuclear Electronics. I." (In English)

When large portions of the pulse height spectra from inorganic phosphors are to be used, either limiting or triggering at a low signal level followed by pulse shaping is required to obviate the effect of pulse height generated time delay. A wide pulse height dynamic range coincidence circuit designed for this utilization is described. Activated sodium or cesium iodide crystals are used to generate volt level pulses by employing suitable high voltages on standard photomultipliers. A trigger circuit is coupled directly to the photomultiplier last dynode at a high impedance level. The first stage of the coincidence circuit consists of two fast trigger circuits which are given. The second stage of the coincidence unit consists of a modified De Benedetti circuit. A typical coincidence resolution curve obtained by using signal pulses at the photomultipliers covering a wide pulse height range is given. (J.S.R.)

5434

A 100 CHANNEL PULSE HEIGHT ANALYZER UTILIZING DUAL STEP CONVERSION. J. P. MacMahon (Argonne National Lab., Lemont, Ill.). p. 291-305 of "Nuclear Electronics. I." (In English)

A 100-channel pulse height analyzer is described which used a dual-amplitude step-discharge technique in the analog-to-digital conversion process to reduce the maximum conversion time to less than that required for a memory cycle. Two address scalers are incorporated so that the normally additive dead times caused by the conversion and memory cycles can occur simultaneously. The analog-to-digital converter, dual address scaler, magnetic core memory, and a transitorized memory are discussed, and circuits are given. (J.S.R.)

5435

HALF-LIFE MEASUREMENT IN THE MICRO- AND MILLISECOND RANGE. M. S. Malkin (Yale Univ., New Haven). p. 307-9 of "Nuclear Electronics. I." (In English)

The application of a pulse height analyzer of the stacked discriminator type to the measurement of half lives in the micro- and milli-second range was studied. A block diagram is given of the analyzer. The circuits for a pulse shaper and linear gate to be used with this analyzer are also presented. Preliminary measurements on the bombardment of a thick natural uranium foil with 10 Mev oxygen showed a 12 msec half life. (J.S.R.)

5436

TIME-OF-FLIGHT SELECTOR WITH ELECTROSTATIC MEMORY. Y. Amram, H. Guillon, C. Hugot, and J. Thenard (Centre d'Etudes Nucléaires, Saclay, France). p. 311-16 of "Nuclear Electronics. I." (In French)

The design studies and construction of a time-of-flight selector with electrostatic memory are described. The electrostatic memory consists of 14 cathode tubes on which numbers will be stored in the natural binary form in parallel. The instrument is designed to have 2000 channels of 0.1 μ sec and a dead time of approximately 1 μ sec. The reasons determining the choice of the type of memory tube are discussed in detail. The methods of beam deflection and the arrangement of the storage areas are described. The circuits of addition and regeneration are also considered. (J.S.R.)

5437

A VERSATILE PULSE HEIGHT ANALYSER UTILIZING PHOTO-PICK-UP SORTING OFF A C.R.T. SCREEN. R. V. Gåsström (Rijksuniversiteit, Groningen, Netherlands). p. 317-31 of "Nuclear Electronics. I." (In English)

The principle of digital sorting with the help of photo-pickup elements off a C.R.T. screen was investigated. The d-c coupled circuit used for the display on the C.R.T. screen is given. The photo-pickup element and its prop-

erties and circuitry are discussed. Initially, phototransistors were used for the light pickup, but at present silicon photovoltaic cells are used. The conformity and stability of the pulse height distribution are discussed. The applications of the pulse analyzer with photo-pickup sorting are considered. (J.S.R.)

5438

ORIENTATION OF REACTOR CONTROL. CONTROL BY TEMPERATURE ONLY. J. Weill (Centre d'Etudes Nucléaires, Saclay, France). p. 335-42 of "Nuclear Electronics. I." (In French)

The possibility of controlling reactors by temperature alone is examined. Prompt divergence and a too rapid temperature rise are considered. (J.S.R.)

5439

TECHNIQUES USED TO EVALUATE THE DYNAMIC PERFORMANCE OF A NATURAL RECIRCULATION BOILING WATER REACTOR. J. A. De Shong, Jr. (Argonne National Lab., Lemont, Ill.). p. 359-69 of "Nuclear Electronics. I." (In English)

The internal power-to-reactivity feedback in boiling water reactors determines the dynamic performance of the reactor. The measurement of the power transfer function, the ratio of the flux output to the reactivity input, requires considerable accuracy if the function is to be used for reactor stability analysis. Graphical analysis of the flux wave form does not produce sufficient accuracies because of the signal-to-noise ratio of the EBWR. A wave analyzer utilizing correlation of the output flux signal with respect to the reactivity input signal was developed. A block diagram of the analyzer is shown, and the correlator is shown in detail. The analyzer under laboratory conditions, using noise-free input signals generated by the zero potentiometer, produces measurement accuracies of better than ±0.5% for the amplitude and ±0.5° for the phase of i_ω/i_ϕ. The accuracy in the presence of noise is less, but in actual operating conditions it is ±5% in amplitude and ±2° in phase, with signal-to-noise ratios greater than one. (J.S.R.)

5440

THE CHANGING PHILOSOPHY OF REACTOR SAFETY CONTROL. Frank Larin and Albert B. Van Rennes (Bendix Aviation Corp., Detroit). p. 371-6 of "Nuclear Electronics. I." (In English)

The four techniques or methods employed by reactor designers to improve control system reliability are failure-to-safety circuits, redundancy and coincidence circuits, monitoring and test circuits, and reliable components. These techniques are examined and some of the approaches made to improve reliability are illustrated. The development of power reactors has increased the need for reliability of safety control, but also requires that shutdowns be prevented except when necessary. These requirements of power reactors have shifted the reliance on failure-to-safety, redundant, and monitoring circuits to reliance on coincidence circuits, test circuits, and the use of solid state components. The interest of the designer in safety control has expanded to include the primary coolant system, the steam system, and the turbines. (J.S.R.)

5441

HIGH TEMPERATURE DETECTORS OF THERMAL NEUTRONS. J. P. Duchêne, L. Koch, J. Tachon, S. Tarassenko, and P. Zaleski (Centre d'Etudes Nucléaires, Saclay, France). p. 377-90 of "Nuclear Electronics. I." (In French)

Three thermal neutron detectors are described, an activation detector, fission ionization detector, and a new type based on a measurement of fission atoms. The activation detector described is used in problems of reactor control. The electronic part of the detector and its performance are discussed. The fission ionization chambers are used for the control of critical concentrations of Pu, and they are described. The results of temperature tests are reported. The principle of the fission-atom detector consists of placing in the neutron flux a fissile product and of capturing in a stream of gas the xenon and krypton atoms emitted during fission recoil. The gas activity is proportional to the neutron density. The performance of such a detector is discussed. (J.S.R.)

5442

AUTOMATIC OPERATION OF THE EL-3 REACTOR. P. Dandurand (Compagnie Francaise Thompson-Houston, Bagneux, France). p. 391-400 of "Nuclear Electronics. I." (In French)

A brief survey is given of the specification requirements in the automatic control of the EL-3 Reactor. The methods of measurements used to determine the different components of the control signal are examined, and the chain of command is outlined. The results obtained since the start-up of the EL-3 are reviewed. (J.S.R.)

5443

DEVELOPMENT OF THE CONTROL OF THE G-2 REACTOR. C. Di Giacomo. p. 401-11 of "Nuclear Electronics. I." (In French)

The G-2 reactor is a natural uranium reactor, graphite moderated and cooled with carbon dioxide. As it is a plutonium breeder, the neutron flux must be maintained near its maximum. The equations for the transfer functions are derived, and the control rods, the drive motor, and the control amplifier are discussed with reference to these functions. The development of the amplifier is considered. The safety circuits are given for manual and automatic control. (J.S.R.)

5444

ELECTRONICS IN DETECTORS OF CLADDING RUPTURES. J. Goupil and J. P. Graftieaux (Centre de'Etudes Nucléaires, Saclay, France) and J. M. Servent (L'Electronique Appliquée, Paris). p. 413-26 of "Nuclear Electronics. I." (In French)

The detectors for fuel element rupture used in the G-1, EL-2, and G-3 reactors are briefly described. The systems being developed include an ionic valve, evolumeter (instrument for measurement of the evolution of fission products), and analog study of radioactive decay chains. Each of these is described. (J.S.R.)

5445

CONTROL OF THE MELUSINE REACTOR. P. Jover (Centre d'Etudes Nucléaires, Saclay, France). p. 427-33 of "Nuclear Electronics. I." (In French)

A brief survey is given of the control system of the swimming pool reactor, Melusine. Neutron flux measurements, neutron flux control, and safety circuits are discussed. (J.S.R.)

5446

DETECTION OF THE LEAKS OF HEAVY WATER FROM A REACTOR INTO THE LIGHT WATER OF ITS EXCHANGERS. C. Julliot, A. Lansiart, and D. Nordemann (Centre d'Etudes Nucléaires, Saclay, France). p. 435-40 of "Nuclear Electronics. I." (In French)

Leak detectors capable of detecting heavy water leaks

of 20 ppm per hour into light water and with a rapid response are required for the EL-3 Reactor. Several methods were investigated, and the one chosen for further investigation was based on the measurement of the radioactive products in the light water. The general scheme of the leak detection system is given. The apparatus measures the gamma activity of the light water and initiates an alarm if there is a sudden increase of activity. To prevent shutdown because of false alarms, each alarm signal causes an auxiliary system to remeasure the activity. (J.S.R.)

5447

THE PROBLEM OF AUTOMATIC START-UP OF POWER REACTORS. C. Samuel. p. 441-6 of "Nuclear Electronics. I." (In French)

The process of reactor start-up is reviewed with emphasis on the control problems. A method for the automatic control of a power reactor during start-up is proposed. (J.S.R.)

5448

L'ELECTRONIQUE NUCLEAIRE. II. COMPTES RENDUS DU "COLLIOQUE INTERNATIONAL SUR L'ELECTRONIQUE NUCLEAIRE" ORGANISE PAR LA SOCIETE FRANÇAISE DES RADIOELECTRICIENS, PARIS 1958. (Nuclear Electronics. II. Proceedings of the International Symposium on Nuclear Electronics Organized by the French Society of Radioelectricians, Paris, 1958). Vienna, International Atomic Energy Agency, 1959. 383p.

5449

RECENT PROGRESS IN THE SIMULATION OF NUCLEAR PHENOMENA. Paul Braffort (Centre d'Etudes Nucléaires, Saclay, France). p.3-7 of "Nuclear Electronics. II." (In French)

A brief review is given of the more recent progress in the simulation of nuclear phenomena. A bibliography of the more important publications is presented. (J.S.R.)

5450

THE CONCEPTUAL DESIGN OF A POWER-LIMITING SYSTEM FOR A SODIUM COOLED ATOMIC POWER PLANT. James H. Talboy, Jr. and Earl H. Lemon (Bendix Aviation Corp., Detroit) and Richard G. Olson (Atomic Power Development Associates, Inc., Detroit). p.9-18 of "Nuclear Electronics. II." (In English)

An analytical study was made of the conceptual design of the power-limiting system of the Enrico Fermi Reactor. A block diagram of the computer system used is given. The philosophy of the power-limiting system is reviewed, and the considerations which led to the choice of the setback and sequential scram responses are presented. The signals, derived from flux levels, that are available for triggering the responses of the equipment are described. (J.S.R.)

5451

AUTOMATIC CONTROL OF A RESEARCH REACTOR. G. J. R. Mac Lusky (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.19-27 of "Nuclear Electronics. II." (In English)

The LIDO is a swimming pool enriched uranium research reactor. It became necessary to provide automatic control with minimum modifications to the existing units. A block diagram of the resulting system is given. The only added unit is the modulator-amplifier which takes d-c signals from both deviation amplifier and period meter and gives a-c output proportional to their sum. The circuit of the modulator-amplifier unit is given. The feedback circuit of the second amplifier in the deviation amplifier was modified. The performance of the system was tested and the results are given. (J.S.R.)

5452

THE APPLICATION OF THE SECOND METHOD OF LIAPUNOV TO THE STUDY OF THE AUTOMATIC CONTROL SYSTEMS OF NUCLEAR REACTORS. M. Marinescu and V. M. Popov (Ecole Polytechnique, Bucharest). p.29-37 of "Nuclear Electronics. II." (In French)

Liapunov's second method is applied to the study of the stability of reactors and the study includes the supplementary automatic control system. The equilibrium state of a thermal reactor described by the equation $dn/dt = \rho/\tau\, n$, where n is density of thermal neutrons, ρ is reactor reactivity, and τ is the average thermal neutron life in a reactor with finite dimensions, is defined and the stability of this equilibrium state is examined. The non-linear oscillations appearing in the control, the effect of a corrector signal proportional to the reactivity, and the effect of delayed neutrons are examined. (J.S.R.)

5453

NON-LINEAR KINETICS AND STABILITY STUDIES ON ANALOG COMPUTERS. H. A. Sandmeier (Argonne National Lab., Lemont, Ill.). p.39-55 of "Nuclear Electronics. II." (In English)

Analog studies of non-linear fast reactor kinetics were made, and a description and diagram of the simulation is given. The results obtained are discussed. It is shown that the EBR-I Mark II may be stable for small disturbances at a certain power level, but will not be stable for sufficiently large disturbances because of the product term $K_{ex}n$ in the kinetic equations. The stability of a linear system is independent of the disturbance but a non-linear system is not. Self-sustained oscillations can be visualized in a fast reactor operating on a high power level when the bowing of the fuel pins is limited. These conditions are simulated, and the mechanism for self-sustained oscillations is discussed. (auth)

5454

NON-LINEAR STABILITY OF NUCLEAR REACTORS. Henri B. Smets (Brookhaven National Lab., Upton, N. Y.). p.57-65 of "Nuclear Electronics. II." (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 13 as abstract No. 18699.

5455

SIGNAL-FLOW GRAPHS AND STABILITY ANALYSIS OF NUCLEAR REACTORS. A. B. Van Rennes (Bendix Aviation Corp., Detroit). p.67-74 of "Nuclear Electronics. II." (In English)

A flow graph for an elementary reactor model is formulated from physical reasoning, and the general transfer function, which relates the response in neutron concentration to the excitation from a neutron source inserted in the reactor, is derived. The characteristic frequencies of the transfer function are examined for their dependence on excess multiplication factor, and the kinetics of sub- and supercritical operation are interpreted. Because adjustment of the multiplying parameter of a reactor is the more common method of excitation, a flow graph for this mode of operation is then derived. The kinetics of the reactor under this condition of excitation are shown to be identical with those for neutron source excitation. Limitations on use of the resulting transfer function are outlined. (auth)

5456

THE SIMULATION OF LARGE NUCLEAR POWER PLANTS. Denise Bettembourg and Max Déat (Centre

d'Etudes Nucléaires, Saclay, France). p.75-84 of "Nuclear Electronics. II." (In French)

The simulation of large nuclear power plants poses certain problems such as the kinetics and automatic control of reactors, thermal exchanges, piping, rotating groups, and control media. The calculating capacity of the machine and the precision desired necessitate compromises and approximations. Among the problems to be answered in the simulator study of nuclear power plants are the orders of magnitude, approximations, and supplementary instrumentation. These are discussed, and the method of solution is indicated. (J.S.R.)

5457

A PROBLEM ON A COOLANT ACCIDENT IN THE EL-3 REACTOR. G. Bianchi, J. Brasseur, C. Caillet, and M. Thonnet (Centre d'Etudes Nucléaires, Saclay, France). p.85-90 of "Nuclear Electronics. II." (In French)

An analog study was made to predict the evolution of the mean uranium temperature during an accident to the coolant system of the EL-3. The accident was introduced in the computer by modification of the parameter which expresses the efficiency of the system in the thermal equations. Two studies were made—one corresponding to a half loading and the other to a full loading. The results are given. (J.S.R.)

5458

STUDY OF THE CONTROL OF THE EDF-1 NUCLEAR POWER PLANT BY MEANS OF AN ANALOG COMPUTER OR A DIFFERENTIAL ANALYZER. G. Deloux, M. Kleinpeter, and L. Laurent (Electricité de France, Paris). p.91-7 of "Nuclear Electronics. II." (In French)

For the analog study of the control of the EDF-1, it was necessary to subdivide the problem. Separate studies were made of the reactor, the chemical and thermal portion, and the high- and low-pressure exchangers. The different elements were then interconnected to represent the complete power station for which various methods of control could be represented. The representation of the various parts of the problem are briefly reviewed. Typical results are indicated. (J.S.R.)

5459

ANALOG STUDY OF PRESSURIZED WATER REACTORS AND ASSOCIATED NUCLEAR POWER PLANTS. J. D. Le Franc (Compagnie Française Thompson-Houston, Bagneux, France). p.99-114 of "Nuclear Electronics. II." (In French)

An analog study was made of a pressurized water reactor and its associated power plants. The reactor studied is of the enriched uranium oxide type with pressurized water. The water acts as both moderator and coolant. It circulates in two identical primary circuits leading to evaporator exchangers. The heat energy produces steam in the secondary circuit which feeds two identical turbogenerators. The equations used in the study are given. The perturbations to the system which were studied included an abrupt introduction of excess reactivity, malfunction of the coolant system, variations in the turbine load, and variations in heat transfer between oxide and coolant. (J.S.R.)

5460

EQUIPMENT FOR PROSPECTION AND PROTECTION. J. Labeyrie (Centre d'Etudes Nucléaires, Saclay, France). p.121-36 of "Nuclear Electronics. II." (In French)

As the principles on which prospection and protection apparatus are based are essentially identical, the most recent developments of both are reviewed together. Typical apparatus are discussed. (J.S.R.)

5461

APPLICATION OF ELECTRONICS TO THE SEPARATION OF URANIUM MINERALS. CONTROL AND REGULATION OF THE CHARACTERISTICS OF THESE MINERALS AT DIFFERENT STAGES OF THEIR CONCENTRATION. J. Berbezier, G. Hubert, and M. Perulli (Recherches et Exploitations Minieres, France). p.137-55 of "Nuclear Electronics. II." (In French)

In addition to the preconcentration methods used for nonradioactive minerals, methods based on the radioactivity of uranium minerals can be used for sorting and classification. The gamma radiation emitted is the only usable radition for use with rocks and stones. The counting cylinder for classification of lots and the method used for rock by rock sorting are described. The control of the conveyer belt is discussed. The control for the feed of concentration plants working with mineral pulps is also considered. Results obtained for the different systems are given. (J.S.R.)

5462

APPARATUS FOR THE DETECTION OF CARBON-14 AND TRITIUM. R. Bibron, G. Delibrias, and C. Léger (Centre d'Etudes Nucléaires, Saclay, France). p.157-61 of "Nuclear Electronics. II." (In French)

In order to measure the low activities of carbon-14 and tritium, they must be introduced into the counter itself. Three such detectors are described. A proportional detector designed for use in carbon dating is first discussed. It is filled with carbon dioxide containing the activity to be measured at atmospheric pressure. A liquid scintillation detector for carbon-14 detection and measurement is also described. Paraldehyde is the solvent used in this detector. A scintillation detector for the determination of weak tritium activities is described. The tritium is introduced in the form of triated water, and the scintillator is filled with 5 parts xylene, 5 parts paradioxana, and 3 parts methyl alcohol by volume. The performance of each detector is discussed. (J.S.R.)

5463

DETECTION OF PLUTONIUM IN AIR BY APPLICATION OF COINCIDENCE TECHNIQUES. A. Blanc and G. Roux (Centre d'Etudes Nucléaires, Saclay, France). p.163-8 of "Nuclear Electronics. II." (In French)

An apparatus for the detection of plutonium aerosols is described. It is based on the determination of the difference between the total α activity and the α activity caused by radon-thoron deposits. The radon-thoron activity is caused essentially by RaC′ and ThC′, which are formed by the beta decay of RaC and ThC. The transformations can be determined with precision because of the emission of an alpha particle a relatively short time after the emission of a beta. A schematic diagram of the apparatus used is given. The results obtained show that the use of the β-α pseudocoincidence technique permits the detection of 1 dose-day of plutonium. (J.S.R.)

5464

GAMMA SPECTROGRAPHY FOR THE STUDY OF THE RADIOACTIVITY OF THE HUMAN BODY. A. Lansiart and L. Jeanmaire (Centre d'Etudes Nucléaires, Saclay, France). p.169-81 of "Nuclear Electronics. II." (In French)

An apparatus for the detection of the gamma radiation in the human body is described, and the results obtained with it are cited. The spectrometer uses a large NaI(Tl) crystal (20 cm in diameter and 10 cm high). The crystal is optically coupled with a photomultiplier. A cathode follower carries the pulses to an amplifier. Operational

tests showed that the instrument gives a linear response as a function of the energy and that it has good stability. Studies on the natural radioactivity of the body, contamination in man, elimination of a radioelement from the body, and the irradiation of rats with neutrons are briefly described, and the results are indicated. (J.S.R.)

5465

DIFFERENTIAL IONIZATION CHAMBER FOR THE MEASUREMENT OF THE ACTIVITY OF RADIOACTIVE GAS. J. Marvaud (Société Alsacienene de Constructions Mećaniques, France). p.183-191 of "Nuclear Electronics. II." (In French)

The measurement of the activity of radioactive gas with an ionization chamber is difficult and sometimes impossible because of the presence of ambient radiation. In order to suppress the effects of the ambient radiation a differential ionization chamber was designed and constructed. The instrument consists of two collecting electrodes in identical chambers, but fed by opposing voltages. Only one of the chambers receives the gas to be measured. As the two chambers have the same sensitivity, the exterior radiation produces the same ionization current in both, but of opposite sign. The residual current furnished by the two chambers corresponds, therefore, to the activity of the gas being measured. A single amplifier is used. The differential ionization chamber is sketched, and the results of some measurements made to determine the characteristics of the chamber when it is used for the measurement of very weak activities are given. (J.S.R.)

5466

THE MONITORING OF RADIOACTIVE EFFLUENTS. G. D. Smith (Plessey Nucleonics Ltd., Northampton, Eng.). p.193-207 of "Nuclear Electronics. II." (In English)

The requirements in the monitoring of radioactive effluents in nuclear plants are briefly discussed, with a consideration of the disposal of the effluent, the sensitivity needed, and the types of measurements. The use of Geiger and scintillation counters is reviewed. Techniques of continuous monitoring are then discussed in detail. Typical sampling cells and a schematic diagram of a continuous effluent monitor are shown. The electronic counting circuits used in continuous monitoring installations are described. Circuits and performance are given for counting rate meters, integrators, alarm circuits, and activity integrators. (J.S.R.)

5467

THE HANDLING OF DATA FROM NUCLEAR EXPERIMENTS. H. I. Pizer (European Council for Nuclear Research, Geneva). p.215-21 of "Nuclear Electronics. II." (In English)

Nuclear experiments with particle accelerators can be divided into counter experiments and track experiments. In counter experiments, scalers are an important source of information. The automation of reading the numbers from the scalers is described, and the recording and analysis of pulse height information is considered. Track experiments include bubble, cloud, diffusion, and scintillation chambers and emulsions. The principle of reading instruments for obtaining the information from the chamber photographs in digital form suitable for a computer is given. The filament scintillation counter is discussed. (J.S.R.)

5468

A TWO-DIMENSIONAL KICKSORTER WITH MAGNETIC DRUM STORAGE. Robert L. Chase (Brookhaven National Lab., Upton, N. Y.). p.223-31 of "Nuclear Electronics. II." (In English).

A kicksorter, which is multichannel with respect to two simultaneous inputs and which therefore extends the advantages of multichannel data collection to a second dimension, is described. The two-dimensional instrument contains circuits for converting analog amplitude information into digital addresses, a memory of suitable speed and capacity, a cathode ray tube spectrum display, and provision for data printout. Each of these is described and discussed in some detail. (J.S.R.)

5469

AN APPARATUS FOR THE COUNTING AND RECORDING OF MEASUREMENTS OF A GROUP OF SCALERS. J. Delhove and E. Goursky (Centre d'Etudes de l'Energie Nucléaires, [Brussels]). p.233-9 of "Nuclear Electronics. II." (In French)

An apparatus for the automation of the enumeration and recording operations of the results of a group of scalers is described. The scalers used are of two types—a slow type consisting of six decatron decades and a fast type consisting of a beam-switching-tube decade followed by five decatron decades. The programming unit gives unblocking pulses to the scalers according to a predetermined program. The operational schemes used for decay measurements and for the spectrometry of samples with short half life are illustrated. The transcription unit is given, and the principle is discussed. The separation of the functions of counting and transcription is described. (J.S.R.)

5470

ELECTRO-MECHANICAL METHODS OF RECORDING MEASUREMENTS IN EXPERIMENTS ON COSMIC RADIATION AND THEIR EVALUATION WITH COMPUTERS. H. D. Rathgeber, C. S. Wallace, and M. M. Winn (Univ. of Sydney). p.251-4 of "Nuclear Electronics. II." (In French)

The "Silliac" computer was used to make completely automatic complex measurements necessitating much numerical analysis. The elements of the equipment used for the measurement either of events whose nature is to be studied as extensive cosmic showers or of variations of the intensity of cosmic radiations. A block diagram is given of the general arrangement of the system, and the operation of the control circuit is described in detail. The amplifying and suppressing circuit and the continuous valued memory circuit are given. (J.S.R.)

5471

CENTRALIZATION AND ANALYSIS OF MEASUREMENTS IN A NUCLEAR POWER PLANT WITH GAS-COOLED REACTOR. Jean G. Auricoste (Société Intertechnique, Paris). p.257-65 of "Nuclear Electronics. II." (In French)

The apparatus designed for the analysis of results from the detectors of cladding ruptures in the EDF-1 reactors is described. The rupture detection is based on the determination of Rb and Cs formed by the fission gases. The precision demanded in the calculations, the permanent and temporary memory requirements, and the data printout needs necessitated the use of a numerical computer. The computer used is described, and the system of the cladding rupture detection is sketched. The requirement of absolute reliability led to the incorporation of a system of program-tests which will automatically give an alarm in the care of malfunction. The centralization of temperature measurements of CO_2 and of conventional power plant measurements utilizing the same numerical calculation is described. (J.S.R.)

5472

RAPID MULTI-MEASUREMENTS. A. Chaye (Compagnie Française Thomson-Houston, Paris). p.267-76 of "Nuclear Electronics. II." (In French)

The device designed for the measurement of the temperatures in the heavy water channels of the El-3 reactor is described. The measurement must be made in 99 channels in 2 to 3 sec and the quasi-simultaneous measurements reported on a single indicator under the surveillance of the operator. The principle of the device consists in the connection of the thermoelectrical thermocouples to a rotating connector which feeds a special device called the "Onduleur." The onduleur transforms the direct input voltage from the couples into alternating voltage proportional to approximately 3750 Hz/sec with a voltage gain of the order of 40. This alternating voltage is repeated and amplified by a tube amplifier. The measurements are made with an oscilloscope with synchronous circular scanning with couple contactor. The amplifier output is also fed to alarm devices by the intermediary of detector blocks which activate relays which can be regulated for various thresholds. The components of the system are examined in detail. (J.S.R.)

5473

NUMERICAL CONTROL OF THE DETECTION OF FUEL ELEMENT RUPTURE. J. Gaudferneau (Société d'Electronique et d'Automatisme, Paris). p.277-82 of "Nuclear Electronics. II." (In French)

The utilization of all the data from the detection of fuel element rupture is a very complete sample of "concentration and treatment of data" in which much data must be handled to extract total results. A numerical method of treatment can be obtained by the use of a general purpose computer or by the assembly of specialized electronic system in which each component is designed to perform a specific operation. The latter solution is examined with respect to the numerical control of the detection of fuel element rupture. (J.S.R.)

5474

ADVANTAGES OF MAGNETIC RECORDING IN NUCLEAR PHYSICS. A. Pages (Centre d'Etudes Nucléaires, Saclay, France). p.283-90 of "Nuclear Electronics. II." (In French)

The advantages in the preservation of experimental data and the possibility of obtaining time differences by the use of magnetic recording are shown. Some results obtained in a study of magnetic recording are presented. Amplitude recording, a recording analyzer with length modulation, and a digital recording analyzer are discussed. Amplitude recording does not give very precise results as it is difficult to obtain good linearity and stability. A synoptic diagram of the recording analyzer with length modulation is given. The linearity and stability is of the order of 2%, but the counting rate is very limited. Comparative results of a device spectrum and a recorded spectrum are shown. The digital recording analyzer has a linearity of the order of 1%. The circuit of the transistorized scanning amplifier is given. Several spectra obtained with their analyzer are shown. (J.S.R.)

5475

TREATMENT OF RESULTS IN THE CONTROL OF A REACTOR. E. Picard (Centre d'Etudes Nucléaires, Saclay, France). p.291-6 of "Nuclear Electronics. II." (In French)

The system used in the EDF-1 for the control and evaluation of results from the fuel element rupture detector is described. The principle of the detection system itself is briefly reviewed. The operational diagram of the computer analyzing the results from the detector is given and discussed. The procedure for the data treatment when a rupture is detected is shown. (J.S.R.)

5476

ELECTRONIC CIRCUITS OF THE TIME-OF-FLIGHT SPECTROMETER OF THE BR-1. H. Ceulemans, A. de Keyser, and E. Mies (Centre d'Etudes Nucléaires, Mol, Belgium). p.297-304 of "Nuclear Electronics. II." (In French)

In the time-of-flight spectrometer, the neutron beam is controlled by a shutter. When the shutter is open, a light activates a photo-multiplier which feeds a gating circuit. The pulses from the gating circuit pass to a variable divider, which determines the value of the channel amplitude. The output feeds the variable delay circuit which gives an output pulse after an imposed delay. These pulses activate a chronometer which also receives the pulses from the neutron beam. The circuits of the variable divider and variable delay are given. The program unit controlling the electronic circuits and the memory unit are briefly considered. (J.S.R.)

5477

ARGONNE THREE DIMENSIONAL ANALYZER. James P. McMahon (Argonne National Lab., Lemont, Ill.). p.308-9 of "Nuclear Electronics. II." (In English)

A three dimensional analyzer being developed is briefly described and a block diagram is given. (J.S.R.)

5478

THE USE OF TRANSISTORS IN NUCLEAR INSTRUMENTS. E. H. Cooke-Yarborough (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.313-27 of "Nuclear Electronics. II." (In English)

A survey is made of the utilization of transistors in nuclear instruments. Their use in portable Geiger or scintillation counters, digital computers, pulse analyzers, amplifiers, high pulse circuits, and scaling circuits are discussed and illustrated. (J.S.R.)

5479

STABILIZED POWER SUPPLY OF HIGH QUALITY EMPLOYING TRANSISTORS. E. Baldinger and W. Czaja (Univ. of Basel). p.329-33 of "Nuclear Electronics. II." (In English)

A stabilized power supply, in which the reference voltage is improved without using batteries and in which the reference voltage and the symmetrical preamplifier are placed in a thermostat, is described. The block diagram and the complete circuit diagram of the power supply are given. The thermostat is discussed in some detail. With this power supply the output voltage is variable from 1 to 17 v, with maximum loading current of 2.5 amp at 1 v, 1.5 amp at 10 v, and 0.8 amp at 17 v. The stabilizing factor is $\eta \approx 6000$. (J.S.R.)

5480

NEW TRANSISTORIZED CIRCUITS IN PROSPECTION APPARATUS. L. Hugolin and C. Lallemant (Centre d'Etudes Nucléaires, Saclay, France). p.349-59 of "Nuclear Electronics. II." (In French)

The principal defect in transistors appears in the variation of their characteristics with temperature. The temperature effects were analyzed, and general methods of stabilization were derived. The stabilization methods were applied to the design of impedance matching circuits, linear voltage amplifier circuits, and trigger circuits. The performances of these circuits are described. (J.S.R.)

5481
DEVELOPMENT IN THE FABRICATION OF SOME TYPES OF PHOTOMULTIPLIERS. E. Morilleau (La Radiotechnique, Paris). p.367-76 of "Nuclear Electronics. II." (In French)

The fabrication of photomultipliers is briefly outlined with a consideration of the forming of the glass, wiring, closing, pumping, and measurements. (J.S.R.)

5482
A TRANSISTORIZED EQUALIZER FOR FAST COINCIDENCE WORK WITH SCINTILLATION COUNTERS. R. V. Gasstrom (Univ. of Groningen, Holland). p.377-8 of "Nuclear Electronics. II." (In English)

A brief description and the circuit of an equalizer suitable for nonsecond coincidence work are given. (J.S.R.)

Materials Testing

5483
NON-DESTRUCTIVE TESTING IN NUCLEAR ENGINEERING. W. E. Schall (Solus-Schall Ltd., [London]). Nuclear Eng. 4, 438-40(1959) Dec.

Non-destructive testing methods reviewed include: radiography by x rays and gamma rays, ultrasonic inspection, the magnetic particle test, and eddy and induced current tests. (C.J.G.)

5484
RADIOGRAPHIC INSPECTION. R. S. Forbes (Newton Victor Ltd., [London]). Nuclear Eng. 4, 442-5(1959) Dec.

The application of x-radiographic techniques for examining fuel elements, graphite support struts, and welded joints in heavy plate is reviewed. The possible applications of the linear accelerator and multi-curie source in radiography are discussed. (C.J.G.)

5485
INSPECTION OF NUCLEAR COMPONENTS. A. F. Gifford and B. J. Litting (International Combustion Ltd., Derby, Eng.). Nuclear Eng. 4, 446-7(1959) Dec.

The non-destructive examination of various types of welds, heat exchanger plates, and shielding fabrications by radiographic, magnetic particle, ultrasonic, and scintillation counter methods is discussed. (C.J.G.)

5486
TESTING GRAPHITE STRUTS. R. N. Beech (Powell Duffryn Carbon Products, Ltd., [Hayes, Middx., Eng.]). Nuclear Eng. 4, 448-9(1959) Dec.

A method of x radiography is described which gives a 100% inspection for graphite fuel element struts. Films of the struts can be wet viewed approximately 10 minutes after subjection to the x rays. Advantages of the method are discussed. (C.J.G.)

5487
UNCONVENTIONAL METHODS. J. Cole (Fulmer Research Inst., [Ltd., Stoke Poges, Bucks, Eng.]). Nuclear Eng. 4, 454-5(1959) Dec.

A method for the assessment of corrosion damage by non-destructive testing is discussed. The deterioration of the specimen with time is measured under a comparatively light load in a four-point loading jig. The deflection under the loading is then measured and the effective thickness of the specimen calculated from the deflection. The inspection of enamel finishes by a high-frequency vacuum probe is discussed. A method of spreading cellulose acetate on a polished surface and subsequently examining the plastic replica of the surface under transmitted light can reveal the early stages of crack formation. (C.J.G.)

5488
THE PLASMA JET AND ITS USES. Merle L. Thorpe (Thermal Dynamics Corp., Lehanon, N. H.). Research/Develop. 11, No. 1, 5-9; 11-12; 15(1960) Jan.

The theory and application of plasma jets are discussed. Designs of gas stabilized types are given. A comparison of the plasma jet to other devices for providing heat is made. (C.J.G.)

5489
FUNCTIONAL STANDARDS AND ACCEPTANCE TESTING FOR THE ATOMIC ENERGY COMMISSION. W. M. Anderson, P. W. Callies, and W. C. Hunter (Sandia Corp., Albuquerque, N. Mex.). 28p. of "Proceedings of Fourth Annual Western Electric Interplant Test Set Conference, Winston-Salem, North Carolina, Oct. 21-23, 1959."

Methods of standards control and acceptance testing for the AEC by the Sandia Corporation are discussed. Diagrams and photographs are included of inspection equipment and special test facilities. The primary reference and transfer and secondary reference and transfer standards are given for the calibration of radiation, frequency, microwave, potential, resistance, reactance, length, dimensions, mass, and environmental standards. (C.J.G.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

5490 AECU-4556
Massachusetts Inst. of Tech., Cambridge.
A PRELIMINARY STUDY OF THE POTENTIAL TO KINETIC ENERGY CONVERSION PROCESS IN THE STRATOSPHERE. Robert M. White and George F. Nolan. Sept. 15, 1959. 12p. Contract [AT](30-1)2241. OTS.

The potential to kinetic energy conversion process in the lower stratosphere is evaluated using adiabatically derived vertical velocities for the North American region for a five-day period. Preliminary results suggest the possibility that on the average the kinetic energy of stratospheric motions may not result from a conversion of potential energy within the stratosphere. The further implication is that stratospheric motions are mechanically driven by the motions in the adjacent layers of the atmosphere. (auth)

5491 TEM-1034
Geological Survey, Washington, D. C.
COMPARISON OF SEISMIC SHOCK IN SALT AND TUFF. P. Edward Byerly. Oct. 1959. 10p. OTS.

Methods of predicting the comparative blast equivalence of nuclear shots in salt and tuff are discussed. (W.L.H.)

5492
UMOHOITE FROM CAMERON, ARIZONA. Peggy-Kay Hamilton and Paul F. Kerr (Columbia Univ., New York). Am. Mineralogist 44, 1248-60(1959) Nov.-Dec.

Studies indicate that the hydrous uranium-molybdate, umohoite, is a more widely distributed mineral than has been previously known. The original crystalline material was found at Marysvale, Utah. Similar crystalline material has since been reported by Coleman and Appleman from the Gas Hills district, Wyoming. Recently, a new occurrence in a fine-grained form has been discovered at Cameron, Arizona. A similar fine aggregate has been recognized in recently collected material from Marys-

vale. The identification of fine-grained umohoite has also been confirmed from an undisclosed locality in the U.S.S.R. The change in lattice dimensions under x-ray bombardment or variable conditions of humidity and temperature has constituted a problem in the x-ray-diffraction study of this mineral. In order to overcome this difficulty, the adsorption of the large ethylene glycol molecule into the water positions has been utilized to stabilize the umohoite structure. This may be accomplished without destruction of the structure. Three coexistent structural modifications are recognized in umohoite. These are designated Modes 1, 2, and 3. The modes range in intensity of development as shown by x-ray diffraction. In fine-grained umohoite (Cameron, fine Marysvale and U.S.S.R.) Modes 2 and 3 are better developed than Mode 1. In coarser Marysvale umohoite Mode 1 is more prominent than Modes 2 and 3. The coexistence in the same mineral of three systematic sequences of lattice variation (or modes), each exhibiting a range in crystallinity in response to physical conditions, is an unusual mineralogical feature. (auth)

5493

THE CHAPELLE-LARGEAU AND THE COMMANDERIE URANIUM DEPOSITS (DEUX-SEVRES). H. Sanselme and A. Gerstner (Commissariat à l'Énergie Atomique, Paris). Ann. mines, 30(1958) June. (In French)

The Chapelle-Largeau mine, situated at the edge of granulitic batholith of Mortagne, appears to be closely linked to the connecting tectonic mass. The uranium found there in the usual form of pitchblende fills a network of small hydrothermal quartz veins impregnating intergranitic siliceous intrusions. These intrusions fill explosion faults or breaks which form a converging beam with three principal seams. The deposit, discovered in 1952, explored and prepared to a depth of 170 meters, has been exploited since January 1958. The Commanderie mine, situated 3 kilometers south of la Chapelle-Largeau, occupies a system of faults developed near a rich mylonite zone at the center of the batholith. Discovered in 1955, this deposit has been the object of a complete systematic research on the surface and by boring, followed by a two-level survey down to 95 meters depth. The region above the dip is ready for working and a second reconnaissance is underway to explore down to 190 meters. The rock exists as pitchblende and black products which impregnate the granulite, filled with pebbles of syenite and deposited in irregular masses along a main North-South fault. The distribution of the mineral necessitated a systematic squaring with crosscuts, soundings and borings, shafts and galleries as well as a detailed geological survey to define the form of the deposits, to obtain samples, and to estimate the amount of ore. In the two mines, the use of statistical methods aided by geological observations has led to a correct estimate of the reserves as well as indicating the possibilities for exploiting them. (auth)

5494

ACTIVATION ANALYSIS IN PETROLEUM EXPLORATION RESEARCH. Richard L. Caldwell and William R. Mills, Jr. (Socony-Mobil Oil Co., Inc., Dallas). Nuclear Instr. and Methods 5, 312-22(1959) Nov. (In English)

In many geological studies detection of the principal and minor elements in rocks is of interest. Neutron activation techniques are described for the rapid, quantitative determination of silicon, aluminium, and magnesium, three of the most common elements in the rocks of the earth's crust. The accuracy and reproducibility of the analyses and interferences from other elements in sedimentary rocks are given. Neutrons for activation were produced with Van de Graaff positive-ion accelerators using the reaction deuterium-tritium to give 14-Mev neutrons and the reaction deuterium-beryllium (plus a water moderator) to give slow neutrons. The activation techniques were checked against standard samples previously analyzed by other methods and against known mixtures of pure elements. Typical results obtained in the activation analysis of approximately four hundred core samples are given. The core analyses are described in connection with correlation studies in a limestone formation, identification of dolomite in carbonate rocks, measurement of the shale content of carbonate rocks and aluminum and silicon content of siliceous rocks. (auth)

5495

DETERMINATION OF THE AGE OF THE ELEMENTS. J. H. Reynolds (Miller Inst. for Basic Research in Science, Berkeley, Calif. and Univ. of California, Berkeley). Phys. Rev. Letters 4, 8-10(1960) Jan. 1.

Xenon from the chondritic meteorite Richardton was found to be heavily enriched in Xe^{129}. This isotope almost certainly was formed from the decay of I^{129}, extinct at present as a natural radioactivity. It was calculated that $(0.35 \pm 0.06) \times 10^9$ years elapsed between the time of formation of the elements and the meteorite. From subsequent calculations the age of the elements is placed at close to 4.95×10^9 years. (B.O.G.)

5496

UTILITY OF STRETCH VECTOR CORRELATION COEFFICIENTS. B. N. Charles (Sandia Corp., Albuquerque, N. Mex.). Quart. J. Roy. Meteorol. Soc. 85, 287-90(1959) July. (In English)

Empirical values of the vector stretch correlation coefficient are compared with the total vector correlation as fundamentally defined. The former is apparently sufficiently accurate when applied to temporal stretch alone, up to three days, but when applied to space stretch it may have little meteorological meaning unless it exceeds about 0.3 in large data samples (about 450 daily observations). (auth)

5497

OCCURRENCE OF URANIUM AND THORIUM IN RADIOACTIVE MINERALS. I. E. Starik and K. F. Lazarev. Radiokhimiya 1, 60-5(1959). (In Russian)

In addition to uranium and thorium atoms found in the crystalline lattice of radioactive minerals (monacites and vilkites) a certain percentage of these atoms, in hydrolyzed or insoluble forms, can be found in the distorted regions of the lattice. During leaching by salt solution, pH 1 to 2, the uranium, thorium, or other rare earths convert into a solution, though the mineral does not dissolve. The leaching of these elements is analogous to the leaching of radium isotopes. (R.V.J.)

5498

ON THE ORIGIN OF URANIUM AND THORIUM IN GROUND DEPOSITS OF ANTARCTIC. I. E. Staric, Yu. V. Kuznetsov, and V. K. Legin. Radiokhimiya 1, 321-4(1959). (In Russian)

Studies of uranium and thorium distribution in various fractions of the Antarctic shelf show that the main depositions are found in the brecciated continental rock. (R.V.J.)

5499

A FIELD METHOD FOR DETERMINING URANIUM MIGRATION IN NATURAL WATERS. M. N. Yakovleva and M. A. Shurshalina. Radiokhimiya 1, 445-9(1959). (In Russian)

A field method based on dialysis is suggested for determining the migration of uranium in natural waters. (R.V.J.)

5500
BIBLIOGRAPHY OF U. S. GEOLOGICAL SURVEY REPORTS ON URANIUM AND THORIUM, 1942 THROUGH MAY 1958. Paul E. Soister and Dora R. Conklin. U. S. Geol. Survey Bull. 1107-A. 1959. 171p. $0.50(GPO).

Most of the reports listed in this bibliography are concerned with the geology, mineralogy, or chemistry of U or Th. Also included are reports on Be, Li, and other rare elements of interest in the atomic energy program. (W.L.H.)

5501
AN INTRODUCTORY STUDY OF UTILIZATION OF GEOCHEMICAL CRITERIA IN THE RESEARCH OF ALPINE URANIFEROUS MINERALIZATIONS. M. Dall'aglio, G. Marinelli, and F. Tonani (Comitato Nazionale per le Ricerche Nucleari, Rome). 43p. of "Studi e Ricerche della Divisione Geomineraria, Volume II, 1959." Rome, Comitato Nazionale per le Ricerche Nucleari, 1959. (In Italian)

The structural and weathering conditions of an alpine uranium-bearing ore-deposit (Val Rendena), and the aureoles of hydrogeochemical, "clastic" and pedogeochemical dispersion resulting by them are described. On the basis of general geochemical considerations, and of the particular behavior of uranium, the use of geochemical methods in prospecting uranium bearing deposits is discussed. (auth)

HEALTH AND SAFETY INCLUDING DOSIMETRY

5502 HASL-66
New York Operations Office. Health and Safety Lab., AEC.
NUCLEAR SAFETY IN MANUFACTURING PLANTS. James E. McLaughlin. Nov. 3, 1959. 24p. OTS.

Presented at the 1959 Industrial Health Conference, Chicago, Illinois, April 30, 1959.

Criticality control in the processing of fissionable materials is discussed. Several fundamental criteria are desirable in criticality control. Safety of a configuration should depend on the occurrence of at least two unlikely events. Configurations should be nuclear safe even if totally flooded with water or, if this possibility can be included, account should be taken of other incidental reflectors. In the case of mass control, the possibility of double-batching should be considered. The intentional use of neutron poisons should not be necessary to achieve subcriticality in manufacturing processes. (W.L.H.)

5503 K-1436
[Oak Ridge Gaseous Diffusion Plant], Tenn; Union Carbide Nuclear Co., Paducah Plant, Ky; and Goodyear Atomic Corp., Portsmouth, Ohio.
PREVENTION AND HANDLING OF RADIATION EMERGENCIES. K. W. Bahler, A. F. Rupp, R. H. Lafferty, Jr., J. W. Wachter, L. S. O'Rourke, and C. R. Milone. Dec. 22, 1959. 68p. Contracts W-7405-eng-26 and AT(33-2)-1. OTS.

Studies carried out by a committee which was set up by Union Carbide Nuclear Company and Goodyear Atomic Corporation following the June 16, 1958, incident at Y-12 to review the prevention and handling of criticality and radiation accidents are summarized. The following areas are considered: evaluation of possible accidents, criticality philosophy and procedures, emergency procedures and mutual assistance, radiation alarms and monitors, communications, personnel monitors, area dosimeters, medical procedures, and training. (auth)

5504 UCRL-8919
California. Univ., Berkeley. Lawrence Radiation Lab.
HIGH-LEVEL SPILL AT THE HILAC. Nelson B. Garden and Carroll Dailey. Sept. 24, 1959. 40p. Contract W-7405-eng-48. OTS.

On July 3, 1959, an incident occurred in the Hilac Building when the turning of the wrong valve resulted in pressurizing a helium cooling box, with a resultant blowout of a thin foil. The burst of He gas disintegrated experimental foils made up with 10^{11} dpm of Cm^{244}. The resultant activity was quickly dispersed as airborne particulates throughout the building. The 27 people in the building were evacuated within 10 minutes under surveillance of the Health Chemistry personnel; wherever clothing proved to be contaminated it was removed, and in cases where nose swipes were pertinent they were taken. Although an assumption of a combination of the worst conditions could conceivably have resulted in 1 man's inhaling between 2 and 4 times the calculated allowable inhalation for short bursts, evaluation from air analysis and medical tests indicate that it is unlikely that anyone actually did receive this amount. The building was closed during decontamination procedures, which required about 30 people for 3 weeks in direct decontamination work and 30 people for 3 weeks in indirect work. The cost of labor, material, and other charges related to the spill amounted to about $30,500 without overhead; equipment loss was held to less than $2000. The lost time of operation of the Hilac has been evaluated at $26,000, so that the total loss from the incident amounts to roughly $58,500. The primary cause of the accident was determined to be an error by the experimenter. Steps were taken to help insure against any recurrence of an uncontained radiation spill at the Hilac, and to decrease the danger of exposure to personnel in the event that a spill should occur in the future. (auth)

5505 WT-702(REF.)(Del.)
Armed Forces Special Weapons Project. Field Command, Albuquerque, N. Mex.
RADIOLOGICAL SAFETY OPERATION. Tom D. Collison. June 1953. Decl. with deletions Sept. 15, 1959. 447p. Operation: UPSHOT-KNOTHOLE. OTS.

Radiological safety procedures during the Upshot-Knothole continental atomic test series are summarized. The purpose of the radiological safety plan was to provide for the protection of all persons at or within a radius of 200 miles of the Nevada Proving Grounds, for the maintenance of operational efficiency of personnel involved in the Operation, and for the collection and dissemination of radiological safety information. Data are tabulated and presented graphically. (C.H.)

5506 Y-1280
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
RADIOACTIVITY OF THORIUM AND FEASIBILITY OF IN VIVO THORIUM MEASUREMENTS. R. E. Cofield. Nov. 11, 1959. 28p. Contract W-7405-eng-26. OTS.

Tabulations of the radioactivity in the thorium series decay chain and a discussion of the radioactivity variations possible in non-equilibrium conditions of the decay chain are presented. Experimental data indicate that the daughters of thorium within the human lung may be measured by in vivo gamma spectrometry and related to Th^{232} content for thorium quantities as small as 9 mg, if the activity ratio of Th^{232} : Th^{228} is known for the deposited material. Two crystal gamma coincidence measurements of pairs of the

simultaneously emitted gamma quanta from the daughters are suggested as a promising approach to thorium in vivo measurements. (auth)

5507 AEC-tr-3930
PROPOSAL FOR A METHOD OF REPORTING ON SAFETY. Translated for Atomics International from Energia elettrica 36, 367-8(1959). 9p. JCL.

An outline is presented for reporting on safety of a nuclear power station. (W.L.H.)

5508 AEC-tr-3931
RECOMMENDATIONS FOR PROTECTION AGAINST IONIZING RADIATIONS IN INDUSTRIAL OPERATIONS CONNECTED WITH THE GENERATION OF ELECTRIC POWER FROM NUCLEAR ENERGY. Translated for Atomics International from Energia elettrica 36, 243-9(1959). 16p. JCL.

Recommendations are presented for the protection of personnel against the hazards of radiation in industrial operations connected with the generation of electric power from nuclear energy. (C.H.)

5509
THE HAZARD OF ORALLY PIPETTING TRITIUM OXIDE. Ben Bloom (National Inst. of Arthritis and Metabolic Diseases, Bethesda, Md.). J. Lab. Clin. Med. 55, 164(1960) Jan.

During oral pipetting it was determined that from 5 to 70 mμ/l of water is inspired per operation. The hazards of orally pipetting tritium oxide are discussed. (C.H.)

ISOTOPE SEPARTION

5510 TID-3091
Technical Information Service Extension, AEC.
THE HYDROGEN SULFIDE DUAL-TEMPERATURE PROCESS. A Bibliography of Selected Report Literature. James M. Jacobs, comp. Oct. 1959. 24p. OTS.

References to unclassified reports concerned primarily with development of the Dual-Temperature Process for heavy water concentration are presented. Reports containing corollary information on competitive processes and properties of D_2 are also cited. Report number, author, and subject indexes are included. 73 references. (auth)

5511
A PRELIMINARY APPROACH TO THE CALCULATION OF A WATER–HYDROGEN SULPHIDE DUAL TEMPERATURE DEUTERIUM SEPARATING PLANT. B. Brigoli and S. Villani (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 6, 784-92(1959) Dec. (In English)

An attempt was made to solve some calculation problems connected with the design of a water-hydrogen sulfide dual-temperature deuterium separating plant. The elementary separation factor, and the single-stage enrichment factor were calculated. The optimal enrichments have been derived both for a single stage and a two-stage plant with respect to column volumes. Furthermore, the application of climbing film type heat exchangers for heat recovery in the gas line has been considered. (auth)

5512
PROGRESS IN THE HEAVY WATER PRODUCTION BY THE HYDROGEN DISTILLATION METHOD. Jiří Ružička (Ústav jaderného výzkumu CSAV, Prague). Jaderná energie 5, 340-44(1959). (In Czech.)

Progress in heavy water production on an industrial scale which was accomplished during the interval from the First Geneva Conference in 1955 to the Second Conference, held in September 1958 is summarized. Attention is given to the distillation of liquid hydrogen and to problems connected with this method, e.g., to the problems of rectification columns, purification of raw hydrogen, thermal insulation, and expanders. In conclusion capital investments and operational charges of heavy water production by the hydrogen distillation method and by the combined method of chemical exchange between water and hydrogen sulfide, distillation, and water electrolysis are compared. (auth)

5513
GAS CENTRIFUGES. W. E. Groth (Univ. of Bonn). Research (London) 12, 467-74(1959) Dec.

The theoretical basis of the centrifugal method is discussed. Various types of thermally controlled countercurrent gas centrifuges are described. Enrichment experiments with three different centrifuge models determined the static enrichments, the dependence of the enrichment on the throughput, and the separation potential of the centrifuges. Experimental separation potentials of the gas centrifuge method were compared with the gas diffusion method for the enrichment of the uranium isotopes. (auth)

5514
STRONG-FOCUSING ION SOURCE. Earl T. Kinzer and Howard Carr (Alabama Polytechnic Inst., Auburn). Rev. Sci. Instr. 30, 1132(1959) Dec.

The description of an ion source which employs electrostatic quadrupole lenses in forming a line focus is given. The focused line is utilized as the defining slit for a Nier-type mass spectrometer. The accelerating system consists of a stack of 11 rings, spaced 0.075 in. apart by alumina insulators. Fifteen hundred volts applied to ten 75-k resistors in the vacuum provided 150-v increments to the accelerating rings. (C.J.G.)

MATHEMATICS AND COMPUTERS

5515 AECU-4531
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. July 1959. 23p. Contracts AT(11-1)-415 and Nonr-1834(15). OTS.

Research and development were continued on high-speed computers and mathematical methods. Illiac and IBM-650 use and operation are summarized. (See also AECU-4108.) (W.D.M.)

5516 AECU-4532
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. Aug. 1959. 35p. Contracts AT(11-1)-415 and Nonr-1834(15). OTS.

Research and development were continued on the high-speed computer program and mathematical methods for finite projective planes. Illiac and IBM-650 use and operation are summarized. (For preceding period see AECU-4531.) (W.D.M.)

5517 ANL-6075
Argonne National Lab., Lemont, Ill.
FUNDAMENTAL COMPONENTS OF THE "PACE" ANA-

LOG COMPUTER. William E. Scott. Nov. 1959. 55p. Contract W-31-109-eng-38. OTS.

The analog computer used in this installation was manufactured by Electronics Associates, Inc. The installation consists of two consoles and a test rack. Each console is made up of 56 operational amplifiers, 5 electronic multipliers, 5 diode function generators, 1 noise generator, 8 pot padders, 80 attenuators, and the recording equipment. It is possible to "slave" one console to the other for problems that require more equipment than is available on the one console. The test rack is provided for the purpose of checking the components without causing any loss of operating time on the consoles. (W.D.M.)

5518 ANL-6089
Argonne National Lab., Lemont, Ill.
APPLIED MATHEMATICS DIVISION SUMMARY REPORT [FOR] JULY 1, 1958 THROUGH JUNE 30, 1959. 61p. Contract W-31-109-eng-38. OTS.

The objective of the Applied Mathematics Division is to provide mathematical assistance to other scientists in the Lab. This goal is achieved by (1) conducting research in numerical analysis and other branches of mathematics, (2) providing mathematical consultation, and (3) operating a computational service, using both digital and analog machines. Publications, papers, seminars, lectures, and courses are listed. A summary listing of computer programs developed or in progress is given. (For preceding period see ANL-5954.) (W.D.M.)

5519 CEA-tr-A-366
OBTENTION DE NOMBRES DE HASARD SUR DES MACHINES À CALCULER AUTOMATIQUES. (Obtention of Random Numbers on Automatic Calculating Machines). S. von Hoerner. Translated into French by R. Pfeiffer from Z. angew. Math. u. Phys. 8, 26-52(1957). 35p.

A random number generation method for Monte Carlo calculations is presented in two parts: mathematical technique and physical procedure. The fixed cycle, stable cycle, and degeneration means are defined and analyzed, and a new method is proposed (raise to the square and complement), which avoids stable cycles and degeneration. The technique for using this method on numerical machines of small capacity is discussed. (T.R.H.)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

5520 AECU-4537
General Atomic Div., General Dynamics Corp., San Diego, Calif.
HEAT TRANSFER FLUIDS FOR FUEL ELEMENT CANS. Leo Brewer. Aug. 4, 1959. 4p. Project No. 32. Contract AT(04-3)-314. (GAMD-904). OTS.

The maximum temperature in the interior of the fuel element could be greatly reduced by incorporating a liquid between the fuel element and the outer can to increase heat transfer rates. It is of interest to consider what liquids would be chemically compatible with graphite and the actinide carbides. Elements which melt below 1100 and boil above 1400°C that form no stable solid carbides, include Cu, Ga, Tl, Ge, Sn, Pb, Sb, Bi, and compounds include GeP, GeS, GaP, Ga_2S, GaTe, GaAs, SnTe, Sn_3As_2, Sb_2Te_3, Zn_3Sb_2, Zn_3P_2, ZnS, ZnTe, and Zn_3As_2. Some of these compounds have equilibrium pressures that might be considered too high, but they may actually vaporize slowly enough because of low vaporization coefficients to make them suitable. There are probably not enough data nor adequate theories for predicting the rates, and Langmuir type vaporization experiments would be necessary to determine the rates of vaporization of these compounds. The main problem in the use of a heat transfer fluid is that of reaction between the fluid and the actinide carbides. Thermodynamically extensive attack would be expected. However, it may be possible to make the rate small enough by use of protective coatings for the fuel element or the rate even with direct contact may be small enough to allow use of the fluids proposed. Thermodynamic data used in calculating reactivity of heat exchange fluids with UC_2 are listed. (auth)

5521 AECU-4562
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil and Sanitary Engineering.
THE RESPONSE OF CONCRETE SHEAR KEYS TO DYNAMIC LOADING. Edward G. Nawy and Jayantilal M. Shah. Jan. 1959. 65p. Contract AT(29-2)-616. OTS.

A program for determining the behavior of concrete shear keys under dynamic loading similar to that encountered in nuclear blasts and the behavior of these keys under static loading are described. Results indicate that concrete keys can withstand stresses in pure shear as high as 2000 psi and that the keys exhibit higher shear strength when subjected to dynamic loads than when stressed by static loads. Tests also indicate that the strength and quality of the gravel are probably major factors governing the strength of the keys. (J.R.D.)

5522 AECU-4563
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil and Sanitary Engineering.
BEHAVIOR OF BOND UNDER DYNAMIC LOADING. Atis A. Liepins. Sept. 1959. 101p. Contract AT(29-2)-616. OTS.

A program to determine the bond strength of reinforced concrete under dynamic loading, to compare bond strengths under static and dynamic loading, and to test the adequacy of ACI building code is described. The tests showed that local static bond strengths may be as high as 0.75 f'_c and that under dynamic this strength increases to f'_c. For all practical lengths of embedment of bars, steel failure may be expected under both static and dynamic conditions. (J.R.D.)

5523 AERE-R-3056
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
STRONTIUM CERAMICS AND GLASSES. P. J. Jones. Sept. 1959. 16p. BIS.

Investigation of the leaching, volatilization, and enamel forming properties of glasses and ceramics are reported in the following systems: boron oxide–silicon oxide–sodium oxide–strontium oxide; aluminum oxide–silicon oxide–sodium oxide–strontium oxide; and strontium oxide–titanium(IV) oxide. (auth)

5524 APEX-252
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
COMBUSTIBILITY STUDIES WITH NICHROME V (80Ni–20Cr). J. B. Conway and T. D. McLay. Dec. 1, 1954. Decl. Nov. 20, 1959. 33p. (XDC-54-12-91).

The design and operation of a high temperature, high

pressure combustion rig employing premixed propane-oxygen are described in detail. An electrical "hot-spot" was created in samples of Cr–Ni alloy fuel elements to determine if conditions could exist which would lead to ignition and combustion of the metal. Metal samples were tested at temperatures up to 2690°F and at pressures up to 30 psig. (auth)

5525 BMI-804

Battelle Memorial Inst., Columbus, Ohio.

PROTECTIVE COATINGS FOR HIGH-TEMPERATURE METAL ALLOYS. C. G. Harman, E. F. Fowler, and L. S. O'Bannon. Dec. 15, 1952. Decl. Nov. 20, 1959. 23p. Contract W-7405-eng-92. OTS.

The glasses, Li_2O, CoO, Na_2O, SrO, and SiO_2, with and without additions of clay were studied as coatings for stainless steel. The coatings were subjected to tests for adherence, spalling or flaking due to thermal-shock cycling, and protective properties in air at 1900°F. A glass composed of 26.9% Na_2O, 21.5% SrO, and 51.6% SiO_2 was found to have good adherence, fair resistance to spalling, and appeared to have fair protective properties. (auth)

5526 CEA-947

France. Commissariat à l'Énergie Atomique, Paris.

UTILISATION DES COMPTAGES α POUR L'ETUDE DE L'HOMOGENEITE DE QUELQUES ALLIAGES D'URANIUM. (Use of α Counting in the Study of the Homogeneity of Various Uranium Alloys). J. Engelmann, J. M. Henry, and R. Chazot. Dec. 1958. 13p.

A method for measuring the homogeneity of U-Mo and U-Zr alloys, using the counting of the α particles of uranium in an ionization chamber is described. This method allows the detection of a variation of composition of 0.5 per cent in an alloy containing 90 per cent uranium. (auth)

5527 GEAP-3097

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

HYDROGEN IN ZIRCONIUM. C. N. Spalaris. Dec. 24, 1958. 12p. (R-58-APE-16).

The hydrogen redistribution in Zircaloy-2 fuel jacket was studied, using typical reactor parameters. Based on reasonable assumptions, it was calculated that the critical hydrogen concentration in Zircaloy-2 clad, Dresden type fuel elements is 60 ppm. For Zircaloy-2 fuel jackets having an initial hydrogen content of 40 ppm, the hydride free reactor operating time was calculated to be 1000 days. (auth)

5528 HW-61187

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A MICROSPARK APPARATUS FOR THE STUDY OF INCLUSIONS IN METALS. F. M. Smith. July 22, 1959. 10p. Contract [AT(45-1)-1350]. OTS.

The construction of a microspark unit is described. It consists of a spark stand with sample holding and transport mechanism for both vertical and horizontal motion, and facilities for supporting a counter electrode; plate racking mechanism; a high-speed Hilger medium-quartz spectrograph; and a microspark source developing power up to 6,000 volts at 110 microamperes. With this instrument it will be possible to study inclusions and segregates and make a qualitative appraisal of their constituents. (auth)

5529 HW-61917

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FILTERING ABRASIVE-WHEEL URANIUM CUTTINGS. A. K. Postma and J. D. McCormack. Sept. 18, 1959. 9p. Contract AT(45-1)-1350. OTS.

A number of filters were tested in the search for a device capable of efficiently removing the particles suspended in the 327 Building cut-off cell waste. A two-stage filter system consisting of a five-micron commercial filter followed by a wool felt filter was found satisfactory, removing practically all particles larger than one micron at the required flow conditions. Estimates indicate that the amount of particulate material not retained by this system would be about 2% of that which penetrates the presently used glass wool filters. The over-all decontamination of the cell wastes cannot be accurately estimated because an unknown fraction of the total activity is in solution. (auth)

5530 KAPL-2050

Knolls Atomic Power Lab., Schenectady, N. Y.

ESTIMATES OF THE EFFECT OF BUBBLE SIZE ON FUEL ELEMENT SWELLING. A. H. Willis. Sept. 30, 1959. 14p. Contract W-31-109-Eng-52. OTS.

Fission gases are a source of swelling in irradiated fuel materials; in a mechanically strengthless material only surface tension limits the amount of swelling. In such materials, the amount of swelling depends upon the operating temperature, fuel burnup, and the number of gas-filled bubbles per unit volume of material. Swelling is insensitive to the variety of sizes of the gas-filled bubbles, unless only a very small proportion of the bubbles have an extremely large diameter. (auth)

5531 KAPL-M-CGL-2

Knolls Atomic Power Lab., Schenectady, N. Y.

METAL COATING SCALE-UP AND PROCESS IMPROVEMENT. C. G. Lindquist. Oct. 30, 1959. 14p. Contract W-31-109-Eng-52. OTS.

The current metal coating process as carried out at BMI and KAPL employs a jet type reactor. A discussion is presented of the proper operating conditions for the optimum efficiency of the jet type reactor. (W.L.H.)

5532 MAB-156-M

National Research Council. Materials Advisory Board.

SYMPOSIUM ON THE TESTING AND EVALUATION OF MATERIALS FOR SOLID PROPELLANT ROCKET MOTOR CASINGS, FEBRUARY 2-3, 1959, WASHINGTON, D. C. Nov. 15, 1959. 319p. Contract DA-36-039-sc-76436.

Papers were presented on causes of hydrotest failures in Polaris motor chambers, the acoustics of straining and fracture in notched sheet specimens, fracture mechanics theory and its application to analysis of rocket chamber fractures, crack propagation testing, fracture toughness tests of high-strength sheet metals, sharp notch and smooth tensile characteristics for ultra-high-strength steel sheet alloys, brittle fracture in sheet metals, crack propagation testing of high-strength sheet steels, titanium notch sensitivity and resistance to testing, bulge tests for sheet metal fracture, high-strength materials fracture sensitivity, evolution of ultra-high-strength steels, and development of steel rocket motor cases. (J.R.D.)

5533 NMI-1223

Nuclear Metals, Inc., Concord, Mass.

ALLOY DISPERSION FUEL ELEMENTS. J. Paul Pemsler. Nov. 17, 1959. 27p. Contract AT(30-1)-1565. OTS.

A survey was made of potential dispersion alloy fuel elements consisting of a uranium-containing, fissile, intermetallic phase dispersed in a non-fissile matrix. The intermetallic compounds considered were those of uranium with iron, nickel, aluminum, copper, bismuth, and silicon. Alloys were formed by melting mixtures of the constitu-

ents. On the basis of microstructure, oxidation resistance, and workability, the systems uranium-type 304 stainless steel and U–80 Ni, 20 Cr were chosen for detailed study. Techniques for extrusion of these alloys were developed. Six alloy compositions were fabricated with enriched uranium for irradiation studies. (auth)

5534 NMI-4387(Del.)
Nuclear Metals, Inc., Concord, Mass.
EVALUATION OF SIX ZIRCALOY-CLAD U–2 w/o Zr ALLOY TUBES MADE FOR IRRADIATION IN THE VBWR TEST LOOP. D. F. Kaufman and W. J. Richmond. June 10, 1959. 66p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

Enriched U–Zr power tubes with various component sleeves, seals, and plates were evaluated for testing in the General Electric Test Reactor. The evaluation data are tabulated. (J.R.D.)

5535 NP-6789
Aluminum-Industrie-Aktien-Gesellschaft, Neuhausen am Rheinfall, Switzerland.
BIBLIOGRAPHY [ON] GALLIUM. Pierre de la Breteque, comp. Mar. 1, 1958. 214p.

This bibliography lists studies up to 1957 which have appeared about Ga or Ga compounds since its discovery in 1875. (W.L.H.)

5536 NP-8181
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS. Summary Report No. 3 [for] November 1, 1958 to October 31, 1959. C. R. Mason, J. D. Walton, M. D. Bowen, and W. T. Teague. 124p. Project No. A-212. Contract NOrd-15701.

Evaluation of slip-cast fused silica for use in thermal protection systems was continued. The thermal conductivity of this material was found to vary linearly from 0.18 (Btu ft)/(ft^2 hr °F) at a mean temperature of 291°F to 0.31 at 1652°F. Above this temperature the thermal conductivity increased rapidly. Such treatments greatly increased the conductivity. Thermal conductivity varied from 0.240 (Btu ft)/(ft^2 hr °F) on plates fired at 1700°F to 0.536 on similar plates fired at 2300°F. The change in conductivity is correlated with the amount of cristobalite in the samples. The thermal diffusivity of fired slip-cast fused silica is practically constant over a large temperature range. The ablation rate for this material was 0.001 in./sec in the exhaust of the oxyhydrogen rocket motor. The modulus of rupture was 4300 psi on samples fired at 2150°F, however, this valve dropped on either side of the 2150 to 2200°F temperature range. Preparation of titania by sintering is described, and in tests on shapes having a base coat of Al, titania coatings remained intact after one thermal cycle to 1500°F in air. Thermets composed of approximately 50% Be-nickel monoxide thermite and 50% beryllia show promise and further investigation is in progress. Studies were continued with the Be-chronic oxide for use in thermet compacts, and investigations to determine the characteristics of beryllium–chromic oxide–beryllia thermets were started. Preliminary tests indicate that after ignition this composition should have a make-up of 62% beryllia and 38% chromium. Data on this thermet are tabulated. (For preceding period see NP-7117.) (J.R.D.)

5537 NP-8227
Battelle Memorial Inst., Columbus, Ohio.
DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. M. J. Wahll, comp. Oct. 1959. 84p.

A listing of selected acquired articles, reports, and papers is presented concerning light metals, high-strength alloys, miscellaneous metals, and special subjects such as applications, coatings, fabrication, non-metallic refractories, properties, and thermal protection. (J.R.D.)

5538 NYO-2794
Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.
A PROGRAM TO STUDY THE FEASIBILITY OF AND DEVELOP AN APPARATUS FOR THE ULTRASONIC ROLL BONDING OF FUEL PLATES. Monthly Progress Letter, Task IV. R. K. Steele. Dec. 18, 1959. 7p. Contract AT(30-1)-2379, Task IV. (CEND-2013-MD-8523). OTS.

With this is bound: Aeroprojects Inc., West Chester, Penna. PROGRESS REPORT NO. 4 COVERING THE PERIOD OCTOBER 16 TO NOVEMBER 15, 1959. Harold L. McKaig, Jr. Dec. 7, 1959. 8p. Sub-contract No. 1. OTS.

Weldability studies were continued on a power welder over which good control can be exercised. Results of these weldability tests will be applied in the use of the high-speed bonder. Such equipment capable of bonding 30 in./min is being built. A purchase order is being arranged for the production of dispersion cores and miniature roll-bonded specimens. Sections from face bonded specimens with 0.033 and 0.50 inch bond-band centerline spacings were polished and anodized. The ultrasonic energy effects appear to be concentrated in the clad with very little effect shown in the core. Stud welding parameters were optimized for 0.060 inch aluminum sheet stock. Components of edge bond standards for use in the ultrasonic evaluation were purchased, and a single rolling pack was assembled. (J.R.D.)

5539 ORO-222
Union Carbide Metals Co., Niagara Falls, N. Y.
COLUMBIUM CLAD URANIUM CARBIDE FUEL ELEMENT. Quarterly Report No. 2 for August 1–October 31, 1959. J. J. Finley, Michael Korchynsky, and S. Sarian. Nov. 16, 1959. 17p. Contract AT(40-1)-2559. OTS.

Progress in the following three areas of the uranium carbide technology is reported: (1) preparation of uranium carbide by reacting uranium metal with methane, arc-melting uranium metal and carbon, and reacting uranium dioxide with graphite; (2) consolidation of uranium carbide by powder metallurgical techniques or induction melting and casting; and (3) compatibility studies of uranium carbide and various niobium-base alloys selected as eventual cladding material. (auth)

5540 SCTM-334-59(51)
Sandia Corp., Albuquerque, N. Mex.
THE ELECTRICAL BEHAVIOR OF EXPLODING WIRES. A SURVEY OF VARIOUS MATERIALS. T. J. Tucker and F. W. Neilson. Nov. 30, 1959. Revised Dec. 11, 1959. 112p. OTS.

A survey is presented of the electrical behavior of various metals exploded by a cable discharge system at a current density of approximately 4×10^7 amp/cm^2. Resistance versus inertia and resistance versus energy curves are given for 17 pure metals and a number of alloys. The electrical behavior of gold alloys as a function of the percentage composition is discussed. (J.R.D.)

5541 WADC-TR-59-316
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
MECHANISM OF WEAR OF NONMETALLIC MATERIALS. Period covered: June 1, 1958 to May 31, 1959. Edwin J. Latos. June 1, 1959. 18p. Project title: RESEARCH ON INTERFACE PHENOMENA. Task title: RESEARCH INTO

LUBRICATION, WEAR AND FRICTION. Contract AF33(616)-5962. (ARF-3134-10). OTS.

The principal objective of this project is a basic study to evaluate the mechanism of wear of nonmetallic materials at elevated temperatures. Materials selected included single crystals of sapphire and quartz. A friction apparatus was designed for use at high temperatures and has an operating range of 0 to 50 g load and a speed range of 10^{-3} to 10^{-1} cm/sec. The friction specimens are placed into suitable holders and heated with an induction generator. Initial tests established the reliability of the friction apparatus to operate effectively from room temperature to 1600°F. Design of suitable specimen holders should permit friction studies at temperatures to 4000°F. The coefficient of friction of sapphire on sapphire increased with temperature to approximately 900°F and decreased with further increases in temperature to 1600°F. The coefficient of friction also increased with load in the temperature region reported. (auth)

5542 Y-1080

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

THE MEASUREMENT OF URANIUM CONCENTRATION IN U–Al ALLOY BY GAMMA COUNTING. John W. Wachter and William B. Wright. June 16, 1954. Decl. Nov. 23, 1959. 15p. Contract W-7405-eng-26. OTS.

A NaI(Tl) scintillation counter was used to measure U concentration in reactor slugs in the range 0.040 to 0.075 gm U/gm by counting the gamma radiation from the uranium. A test was performed on 50 cast slugs, consisting of 5-slug samples from 10 different melts. Measurement precision was determined to be ±0.50% LE (0.05)(relative) for a single determination (one count on one end of one slug). Analysis of variance revealed that, if there were no other sources of error, a relative error of ±1.94% would result from variations in uranium concentration between ends of a single slug, and an error of ±1.56% would result from concentration differences among melts. Consequently, if applied to production monitoring of these cast slugs, the precision of determining average melt concentrations is increased to ±1.43% LE (0.05)(relative) for a 1-slug sample, ±0.69% for a 5-slug sample, and ±0.15% for a perfectly homogeneous melt. (auth)

5543 CEA-tr-A-519

L'OXYDATION INTERNE DU CUIVRE–SILICIUM. (Internal Oxidation of Copper–Silicon). W. Gruhl and S. Von Engelman. Translated into French from Metall. 12, 985-9(1958). 21p.

Measurements were made of the weight increase of Cu–Si alloys of varying Si content upon heating in air between 60 and 300°C. Microscopic and radiographic examinations were made and discussed. (T.R.H.)

5544 CEA-tr-A-597

L'EFFET DES VIBRATIONS INTENSES SUR LES FUSIONS MÉTALLIQUES. II. L'IMPORTANCE DE LA FRÉQUENCE ET DE L'INTENSITÉ DES VIBRATIONS VIS-À-VIS DE L'AFFINAGE DES GRAINS. (The Effect of Intense Vibration on Metallic Melts. II. The Importance of Frequency and Intensity of Vibrations with Respect to Grain Refinement). G. Schmid and A. Roll. Translated into French from Z. Elektrochem. 45, 769-73(1939). 21p.

Wood alloys of low melting point, which exhibit a needle-shaped crystal form, were subjected to sonic and ultrasonic vibrations (50, 900, and 284,000 cps and intensities from 1 to 40 w/cm^2). The effect of the vibration on grain refinement was studied by observing the shortening of the needles. It was found that the needles were shorter for the more intense vibrations, and the frequency played no role or only a subordinate role. The grain refinement is attributed to friction forces which intervene between the metallic bath and the precipitated crystals. An approximate calculation made it evident that these friction forces are comparable to those of the resistance of the needles. (T.R.H.)

5545 IGRL-T/R-57

THE INFLUENCE OF HYDROGEN AT HIGH PRESSURE ON UNALLOYED STEEL AND THE INFLUENCE OF ALLOYING ELEMENTS ON THE STABILITY OF STEEL TOWARDS HYDROGEN AT HIGH PRESSURES. F. K. Naumann. Translated by G. P. Cook (U.K.A.E.A., Risley) from Tech. Mitt. Krupp, A. Forschungsber., p.207-43 (1938). 49p.

PAPER 1. The causes and consequences of hydrogen corrosion, taking as examples some corroded structural parts from high-pressure installations, are briefly described. Experiments were conducted which investigated the influence of pressure, temperature and time on the start and continuation of the decarburization of unalloyed steel. The beginning of the corrosion is considerably influenced by temperature, time and pressure, and once the corrosion has begun it penetrates relatively quickly into the steel after exceeding a (time dependent) stability limit. Decarburization starts at low temperatures (400 to 500°C) in an incomplete branching form and proceeds initially from the grain boundaries and from certain prepared planes inside the grains. The dendritic axes are more quickly decarburized than in the usual mechanically worked steel, and the cold working of steel promotes the start and progress of the decarburization. The tenacity and especially the toughness of the steel is strongly decreased by hydrogen corrosion, and Armco-iron, in spite of its low C content is still corroded by hydrogen. Phosphorus, sulfur and oxygen are not removed from steel under conditions in which decarburization occurs; nitrogen is removed before decarburization sets in without affecting the toughness of the steel. Hydrogen corrosion is basically distinct in form and cause from the usually occurring surface decarburization. The basic difference is that hydrogen corrosion is caused by formation of methane and surface decarburization is due to formation of CO by O (water vapor). PAPER 2. The non-carbide-forming elements Si, Ni, and Cu have no influence on the H_2 stability of steel. Mn, which forms no separate carbide in steel but is taken up in the Fe carbide in considerable quantities, raises the stability only a little. Chromium, W, and Mo cause a strong constant increase of the stability and as these elements are strongly dissolved in iron carbide, the stability depends on the stability of the iron carbide. With Cr steels a discontinuous increase in the stability occurs for a fixed Cr content which is dependent on the C content. It was shown that this phenomenon was due to the occurrence of the special carbide $(CrFe)_7C_3$ or, more correctly, due also to the disappearance of the iron carbide $(FeCr)_3C$. Decarburization phenomena (surface decarburization) were also observed with the Cr steels within the range of hydrogen stability, but are harmless as they do not affect the toughness of the material. The surface decarburization process must be regarded as due to the action of water vapor in H_2. V, Ti, Zr and Nb, after a small increase in the hydrogen stability, show no further improvement and are, in the range examined, surpassed by W and Mo in their action. Only by exceeding a quantity dependent on the C content do these elements bring about an extraordinarily strong increase of the hydrogen stability. By comparison with the phase diagram this behavior could be explained as follows: the

initial increase in stability is traced back to the dissolving of the elements in iron carbide. As the solubility is, however, very small in this range, no real increase in the resistance of the steel follows. By further increases of alloying content—above the solubility limit of the Fe carbide for the alloying elements—the corresponding alloy carbide is formed beside the saturated Fe carbide. As the stability of the steel is fixed by the stability of the least stable carbide, in this case the Fe carbide, it can be concluded that in spite of the quantitative increase of the alloy carbide no further increase in stability results. Only when the Fe carbide has completely disappeared and only the alloy carbide remains does the stability of the steel rise, and this reaches an extraordinarily high value as these elements form very stable carbides. Application of this relationship permits very highly hydrogen-stable steel to be prepared from these elements. The amount of element added need only be small, and the lower the atomic weight of the element concerned the smaller the quantity required, e.g., a steel with 0.10% C and 0.5% Ti or 0.6% V possesses a greater stability than a 3% Cr steel with the same C content and, when allowing for the surface decarburization of the Cr steel, possesses an even greater stability than a 5% Cr steel. It must be noted that the applicability of these steels is limited and they do not, as do the Cr steels, possess a high stability against H_2S and are not suitable for the forging of large pieces. (auth)

5546 NP-tr-329

THEORY OF PLASTIC DEFORMATIONS OF METAL. (Teoriya Plasticheskikh Deformatsiy Metallov). Translated from a Publication of the State Publishing House of Scientific-Technical Literature on Machine Building, Moscow-Leningrad, 1956. 522p. OTS.

Results of investigations of finite plastic deformation in metals are presented. The material may be used as a theoretical foundation for development of approximate engineering methods of calculations related to metal pressure shaping. A general consideration of the three-dimensional problem is examined and analyses of various stressed states are given. Mechanical characteristics of metallic plasticity are presented and methods of analyzing data on finite plastic deformation are included. (J.R.D.)

5547 NP-tr-331

CHEMICALLY STABLE METALS AND METAL ALLOYS. . I. Kornilov. Translated from Khim. Nauka i Prom. 2, 238-45(1957). 29p. OTS.

Properties of chemically stable metals and alloys are discussed and tabulated. Data are included on corrosion of Ti, Nb, and Ta and properties of alloys such as ternary Fe based, Nichrome, Hastelloy, and heat resisting alloys of the ferrite class are given. Theory of chemical stability is also examined. (J.R.D.)

5548 NP-tr-327

BINDING MATERIAL FOR STRUCTURAL OBJECTS MADE OF FOAM GLASS. I. I. Kitaigorodskii (Kitaygorodskiy), M. A. Matveev (Matveyev), G. G. Sentyurin, and A. T. Yagodina. Translated from Steklo i Keram. 15, No. 10, 22-5(1958). 9p. OTS.

Binding recipes for foam glass prepared on the base of liquid glass and caustic magnesite using aqueous magnesium chloride solution as sealants were investigated. A binder composed of caustic magnesite, marshalit, asbestos, and talcum was optimized for cementing foam glass plates, beams, blocks, and other structural components. (J.R.D.)

5549

DIFFUSION OF As AND Sb BETWEEN LIQUID IRON AND IRON SLAG. M. L. Sazonov and L. A. Shvatsman. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 28-31(1959) July-Aug. (In Russian)

Distributions of arsenic and antimony between iron and iron slag at 1600°C in highly dilute solutions show the following magnitudes: $L_{As} = 0.01$ and $L_{Sb} = 0.05$. Oxidized arsenic and antimony diffused in iron form unstable trioxides with weakly expressed acid-base properties. (R.V.J.)

5550

GROWTH OF SINGLE CRYSTALS OF INCONGRUENTLY MELTING YTTRIUM IRON GARNET BY FLAME FUSION PROCESS. R. G. Rudness and R. W. Kebler (Linde Co., Indianapolis). J. Am. Ceram. Soc. 43, 17-22(1960) Jan. 1.

Single crystals of yttrium iron garnet ($Y_3Fe_5O_{12}$) were grown using the flame fusion process, even though the compound is reported to melt incongruently. The growth of these single crystals involves a mechanism different from that which has been proposed for the growth of single crystals of incongruently melting mullite. Crystal boules were grown at varying linear growth rates and analyzed with chemical, x-ray, and metallographic techniques. With high linear growth rates, the samples are uniformly polycrystalline and three-phase, containing Fe_2O_3, $YFeO_3$, and $Y_3Fe_5O_{12}$. When slow linear growth rates are used, single-crystal $Y_3Fe_5O_{12}$ can be grown. The mechanism is discussed. At the beginning of growth the first phase to precipitate is $YFeO_3$, and during this stage in growth the molten cap becomes enriched in Fe_2O_3, compared with the $Y_3Fe_5O_{12}$ composition. The liquid cap composition thus changes to the limit of the peritectic on the Fe_2O_3-rich side, and $Y_3Fe_5O_{12}$ then crystallizes from the bottom of the melt as $Y_3Fe_5O_{12}$ powder is added to the top of the molten cap. The central sections of these boules are single-crystal yttrium iron garnet. (auth)

5551

REACTOR CORE MATERIALS. Technical Progress Reviews, Vol. 2, No. 4. Columbus, Ohio, Battelle Memorial Institute, 1959. 49p. $0.55(GPO) domestic; $0.70 foreign.

A review of developments in U, alpha-U alloys, gamma-phase U alloys, dilute U alloys, Pu and its alloys, thorium and its alloys, refractory fuel and fertile materials, mechanism of corrosion of fuel alloys, and basic studies of radiation effects in fuel materials is reported. Moderator Materials. Developments in graphite, Be, Be alloys, and solid hydrides are presented. Nuclear Poisons. Research and development in Be-containing dispersions are reported. Cladding and Structural Materials. Research on corrosion, Zr-water reactions, radiation effects in nonfuel materials, selected metallurgical aspects of cladding and structural materials, and selected mechanical properties of cladding and structural materials is presented. Special Fabrication Techniques. Developments in melting, casting, heat treatment, hot-working, cladding, welding, brazing, and nondestructive testing are reported. (W.L.H.)

Corrosion

5552 CF-57-7-115

Oak Ridge National Lab., Tenn.

SOME CALCULATIONS OF DIFFUSION CONTROLLED THERMAL GRADIENT MASS TRANSFER. J. J. Keyes, Jr. July 22, 1957. Decl. Oct. 9, 1959. 43p. Contract [W-7405-eng-26]. OTS.

Calculations are presented of the amount of mass transfer to be expected in liquid alkali metal-Ni alloy systems

for two assumed diffusion mechanisms. In one, the boundary layer is assumed saturated and the transfer rate is limited by the rate of diffusion of solute into the liquid. In the other, the mass transfer rate is assumed to be limited by the diffusion rate of a component of the solid alloy to the solid surface. It is concluded that a more general hypothesis is needed. (T.R.H.)

5553 CF-58-9-3
Oak Ridge National Lab., Tenn.
MULTIFACTOR RATIO ANALYSIS (FACTOR ANALYSIS) OF CORROSION DATA USING LOGARITHMIC TRANSFORMATIONS. E. L. Compere. Sept. 3, 1958. 12p. OTS.

A simplified analysis method for the examination of complex corrosion data is presented in terms of data from slurry corrosion toroid experiments. This method facilitates the assignment of average effects to specific imposed experimental variables in a test series. It is based on statistical analysis of variance procedures but emphasizes the use of averages and presents results relative to a chosen reference experimental condition. The use of the logarithm of attack rate results in the expression of the effects of variables as ratios or multiplicative terms. (auth)

5554 HW-61345
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
HIGH TEMPERATURE AQUEOUS CORROSION OF ALUMINUM–PLUTONIUM AND ALUMINUM–SILICON–PLUTONIUM ALLOYS. H. C. Bowen. July 31, 1959. 8p. Contract AT(45-1)-1350. OTS.

Al–Pu and Al–Pu–Si alloys were tested to determine their short term corrosion in 350 and 360°C water. Tests of one day or less duration were done on bare as-cast and bare extruded alloys of varying Pu concentration. The performance of the alloys improves with increasing Pu up to 13%. Cold work drastically decreases performance. Addition of 12 wt.% Si had the effect of rendering the Pu concentration resistant to attack for 24 hours. (J.R.D.)

5555 WAPD-CTA(MEE)-645
Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.
SECOND INTERIM REPORT ON TESTING OF MINIATURE MOTOR TUBES. E. Rau and K. Jakobson. Nov. 7, 1958 17p. Project No. 65b17-04. OTS.

Tests of stainless steel motor tubes (thimbles) which closely simulate actual motor geometry are described in which the thimbles were exposed to submarine reference water in four experiments and to surface vessel reference water in a single test. Data on fabrication and failure conditions are tabulated. (J.R.D.)

5556 CEA-tr-A-364
CORROSION INTERCRISTALLINE ET STRUCTURE DES JOINTS DE GRAINS. (Intercrystalline Corrosion and Structure of Grain Boundaries). F. Erdmann-Jesnitzer. Translated into French from Werkstoffe u. Korrosion 9, 7-16(1958). 37p.

A study was made of the effect of the degree of disorientation (θ) of grains in contact on intercrystalline corrosion. An $AlMg_7$ alloy in a state sensitive to intercrystalline corrosion was prepared by thermal treatment and used in the experiments. Samples with a fibrous texture [1 0 0] were used to facilitate determination of orientation differences using attack figures. The variable darkening of grain boundaries, after a given time of attack by the corrosive agent, served as a measure of grain boundary corrosion. Intercrystalline attack of $AlMg_7$ depends strongly on θ which explains weld fractures and hot fractures due to S in steels. It is shown that the elasto-potential energy of the grain boundaries does not determine the intercrystalline corrosion; this corrosion is caused by the nature and form of inhomogeneous precipitates of one or several phases at grain boundaries for $\theta > 5°$. (T.R.H.)

5557 CEA-tr-R-396
COMPORTEMENT ÉLECTROCHIMIQUE DE L'ACIER INOXYDABLE DANS UNE SOLUTION D'ACIDE SULFURIQUE. (Electrochemical Behavior of Stainless Steel in a Sulfuric Acid Solution). N. Ya. Bune (Boune) and Ya. (Ia.) M. Kolotyrkn (Kolotyrine). Translated into French from Doklady Akad. Nauk S.S.S.R. 111, 1050-3(1956). 11p.

A potentiostatic method was applied to the study of the electrochemical behavior of stainless steel in 1.0N H_2SO_4. The potentiostatic method of measuring polarization has several advantages which appear when compared with data from ordinary methods. The study indicated that surface passivation was not involved but a passivation of the steel by reactions forming metallic ions of lower oxidation states. (T.R.H.)

Fabrication

5558 AAEC/E-41
Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
GRAPHITE FUEL STUDIES. PART 2. FINE GRINDING OF ARTIFICIAL GRAPHITE. J. R. May and R. K. Warner. Mar. 1959. 20p.

Homogeneous dispersions of fissile and fertile material in graphite are being currently considered as fuel for high-temperature, gas-cooled nuclear reactors. A possible method of fuel preparation involves compaction of finely ground artificial graphite with U and Th metal powders. Size reduction of artificial graphite is therefore of interest in the preparation of graphite-fuel compacts. Reactor graphite was successively size reduced in a jaw crusher, pin disk mill and ball mill to give a material 50% finer than 9 microns, and with a B.E.T. nitrogen adsorption surface area ranging up to 18.4 m^2/g. The variables in ball milling were studied, and in particular it was found that Ni-hard balls gave a faster grinding rate, but a higher contamination than was obtained with steel balls. Leaching with boiling HCl was effective in removing contamination introduced by these grinding media. The Rosin-Rammler function, $R = 100e^{-}(x/\bar{x})^n$ applied to the size distributions of the ground graphite. In the size range 70 to 1000 microns, the distribution constant n equalled 1. However, above and below this size range, the distribution constant approximated 2. This high value of n for the sub-sieve range was not previously reported, but is not peculiar to artificial graphite. Other materials were found to have a similar value of n. (auth)

5559 NYO-9035
Stevens Inst. of Tech., Hoboken, N. J. Powder Metallurgy Lab.
SLIP CASTING OF NUCLEAR FUEL ELEMENTS. Report No. II. Gregory J. Comstock, Frances H. Clark, Edward H. Baron, Henry W. Guendel, and Edmund B. Wilson. Dec. 15, 1959. 10p. Contract AT(30-1)-2258. OTS.

Room-temperature tensile properties are given for a series of slip-cast APPR-type UO_2 stainless steel fuel plates. Properties of conventionally fabricated type SM-1 dispersion plates were determined for comparison. Slip-cast fuel plates sintered to 90% density, hot or cold rolled approxi-

mately 30%, and annealed 1 hour at 1120°C showed ultimate tensile strengths equal to those of the conventional plates, slightly lower yield strengths, and tripled ductility. All of the slip cast plates, in the annealed condition, and all of the conventional plates withstood 90° cold bends around a sharp-edged punch (0° radius) without visible cracking. An investigation of the basic variables involved in the slip casting process was started. Techniques for measuring slip stability and castability were evolved and preliminary tests were made. Tests were also started to determine the effect of particle size distribution on the green and sintered densities of slip castings. (auth)

5560 GEAP-3103

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

THE PRESSING AND SINTERING OF RARE EARTH OXIDE PLATES. Hugh Harden. Jan. 5, 1959. 16p.

Fabrication of one hundred plates with a Dy_2O_3 interior sandwiched between Gd_2O_3 exteriors is reported. An additional one hundred eighteen plates were formed with a mixture of 45% Gd_2O_3 and 45% Sm_2O_3. The pressing characteristics, sintered densities, and shrinkages are reported for various starting densities. (J.R.D.)

5561 KAPL-M-MAG-1

Knolls Atomic Power Lab., Schenectady, N. Y.

PROGRESS REPORT ON WELD PENETRATION STUDY OF ZIRCALOY-2 HAFNIUM WELDS AS DETERMINED BY RADIOGRAPHIC INSPECTION. M. A. Gerardi. Dec. 23, 1959. 11p. OTS.

Zircaloy-2–Hf welds made at different current settings to correlate complete weld penetration with the original weld interface shift are reported. All welds were radiographed. Zyglo, macroscopic, and microscopic examinations were run on sections of the welds to justify radiographic findings. Results indicate that an intermittent line appears on weld radiographs at a definite distance from original interface location; however, this is not a rejectable condition. Zyglo tests show that a diffusion bond exists between the parent Hf metal and the surrounding weld metal. (J.R.D.)

5562 NP-8238

Battelle Memorial Inst., Columbus, Ohio.

FUNDAMENTAL STUDIES ON THE MECHANISM OF ULTRASONIC WELDING. Progress Report [for September 15, 1959 to December 15, 1959]. W. J. Lewis, J. N. Antonevich, R. E. Monroe, and P. J. Rieppel. Dec. 15, 1959. 13p. Contract AF33(616)-6268.

Studies were continued on development of fundamental information on ultrasonic welding processes. Welds were made in Cu, Ni, and Ti using the cylinder-plate welding system. Shear-force and tip-displacement data were obtained in making the welds. It was found that complete welding was obtained in using tip displacement at, or above, the point at which maximum shear forces are produced. Incomplete welding was obtained in using tip displacements that produced shear forces less than the maximum. Cracking was not observed in copper welds. Cracks were noted in Ni and Ti welds. Studies were also continued to determine the effects of yield and tensile strength on ultrasonic welding. Al and stainless steel are being used in these studies. In welding the stainless steel best results were obtained by using a spherical tip and clamping the specimens with a welding time of 1.5 to 2.5 sec. (For preceding period see NP-7934.) (J.R.D.)

5563 NYO-2879

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

COMBINATORIAL PROPERTIES OF MACHINE SHOP SCHEDULING. Jack Heller. July 1, 1959. 43p. OTS.

Combinatorial properties of deterministic machine shop scheduling are studied. Expressions for the idle and schedule times are obtained for any schedule. Estimates for the number of different schedules and schedule times are obtained. The question of consistent schedules is discussed and methods for the generation of consistent schedules are exhibited. Various objective functions for the determination of best schedules are given. (auth)

5564 ORO-226

Clevite Corp. Mechanical Research Div., Cleveland.

MONTHLY PROGRESS LETTER NO. 6 [FOR] PERIOD NOVEMBER 1, 1959 TO NOVEMBER 30, 1959. R. H. Baskey. Dec. 10, 1959. 4p. Contract AT(40-1)-2557. OTS.

Procedures are being developed for the fabrication of Al-coated fuel-bearing fiberglas as core material in Al-clad fuel elements. (W.L.H.)

5565 SCTM-373-59(16)

Sandia Corp., Albuquerque, N. Mex.

THE THERMAL EMF OF COPPER–CONSTANTAN THERMOCOUPLES AS A FUNCTION OF JUNCTION FABRICATION. J. L. Hartley. Dec. 11, 1959. 18p. OTS.

Twenty-five thermocouples fabricated by five different methods were tested to detect variations in emf output attributable to the method of junction fabrication. Test results revealed no variation. The test was extended to obtain information on the drift in generated emf after repeated temperature cycling, and to obtain information on the relative mechanical strength of the five methods. The five fabricating methods and special testing equipment are also described. (auth)

5566 WAPD-SFR-Fe-355

Westinghouse Electric Co. Bettis Plant, Pittsburgh.

BACK EXTRUSION OF ZIRCALOY-2 LOWER EXTENSION BRACKETS. J. G. Seton. Dec. 12, 1955. 19p. OTS.

The fabrication of STR Core 4 and SFR Core 1 lower extension brackets by extrusion was investigated. Results obtained indicate that such a fabrication method is practical and results in considerable saving of material and machining time. (auth)

5567 CEA-tr-R-711

LES PARTICULARITÉS DU COMPORTEMENT RHÉOLOGIQUE DES MÉTAUX EXTRUDÉS À L'AIDE D'UNE PRESSE HYDRAULIQUE. (Peculiarities of Rheological Behavior of Metals Extruded by a Hydraulic Press). B. I. Beresnev (Beresnew), L. F. Vereshchagin (Verestchaguine), and Yu. N. Ryabinin (Y. N. Riabine). Translated into French from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 5, 48-55(1957). 18p.

Preliminary results are given from a study of the rheological behavior of metals pressed by a liquid. A laboratory hydraulic apparatus capable of 12,000 atm. was used. The results were analyzed, and several differences between liquid extrusion and punch extrusion were pointed out. The total pressure required for liquid extrusion is less because of reduced friction and reduced pressure loss in the cylinder. A further friction coefficient reduction is gained because of a smaller drawplate or die angle. (T.R.H.)

5568

MACHINING OF COBALT-CONTAINING ALLOYS. C. T. Olofson and F. R. Morral (Battele Memorial Inst., Columbus, Ohio). Cobalt No. 5, 15-25(1959) Dec. (In English)

Machining operations for various cobalt alloys such as drilling, milling, broaching, reaming, shaping, turning, and

facing are discussed. Tool-material guides for high-speed steels, and carbides are presented. (C.J.G.)

5569

IS ELECTRON BEAM WELDING READY FOR THE PRODUCTION LINE? Mars Hablanin (NRC Equipment Corp., Newton, Mass.). Iron Age 185, No. 2, 66-7 (1960) Jan. 14.

The applications of electron beam welding are discussed. An electron beam welding machine which has a maximum operating voltage of 20,000 v with a gun capable of generating 3 kw at a maximum current rating of 150 ma is described. The machine gives a 1:1 ratio. (C.J.G.)

5570

REGULARITIES IN POWDER EXTRUSION SINTERING OF REFRACTORY COMPOUNDS. M. S. Koval'chenko and G. V. Samsonov (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 143-7(1959) July-Aug. (In Russian)

Certain regularities in powder extrusion sintering of titanium and tungsten carbides and molybdenum, titanium, and zirconium borides were investigated. Diagrams are plotted of density and contraction dependence on temperature of extrusion and sintering. (R.V.J.)

5571

WELDING A PRESSURE VESSEL FOR A CANADIAN TEST REACTOR. A. M. Bain (Dominion Bridge Co. Ltd., Montreal) and A. H. Clark and M. J. Lavigne (Canadian Westinghouse Co. Ltd., Hamilton, Ont.). Metal Progr. 77, 96-100(1960) Jan.

The problems encountered in fabricating the Type-347 stainless steel surge tank of the test loop of the NRU reactor are discussed. Type 347 stainless steel (stabilized with niobium) was used to weld the inner 1/4 in. of the longitudinal joint of the 3 in.-thick tank. The remainder of the double-V groove was filled with Type 307 stainless steel plus 1% Mo rod. Welding procedures for the circumferential welds are given. (C.J.G.)

5572

ELECTROPOLISHING OF COLUMBIUM AND TANTALUM. O. J. Krudtaa and K. Stokland (Central Inst. for Industrial Research, Oslo). Metal Progr. 77, 101-3(1960) Jan.

Electropolishing techniques for preparing niobium and tantalum for microhardness measurements are discussed. All electrolytes which proved successful contained hydrofluoric acid. The effect of varying current densities, voltage, and electrolyte circulation rates is studied. (C.J.G.)

5573

HOT PRESSING POWDERS IN ENGLAND. Alan Blainey (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Metal Progr. 77, 104-8(1960) Jan.

Techniques for hot-pressing beryllium and cermet powders into complex shapes, both bare and sheathed, are described. The importance of selecting the proper die materials, lubricants, and temperatures is indicated. (D.E.B.)

Properties and Structure

5574 AECU-4528

Denver. Univ. Denver Research Inst.

STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON-ALUMINUM ALLOYS. Monthly Progress Report No. 8. Frank C. Perkins and Joseph F. Nachman. Dec. 8, 1959. 9p. Contract AT(11-1)-742. OTS.

The effect of variation of Al content, heat treatment, and basic slip mechanism upon the room-temperature ductility of Fe-Al alloys is being studied. (W.L.H.)

5575 AECU-4535

General Atomic Div., General Dynamics Corp., San Diego, Calif.

MELTING POINT OF Th-U-C FUEL ELEMENTS. Leo Brewer. Aug. 3, 1959. 5p. Project No. 32. Contract AT(04-3)-314. (GAMD-901). OTS.

Experiments to provide information on fuel element behavior at high temperatures are discussed. It is felt that an effort should be made to establish a value for the saturated concentration of Th or U in graphite at 2000 to 2500°C. Other experiments considered of value in establishing melting data include determination of solubility of ThC_2 in graphite, U, Zr, and rare earth mixture in ThC_2, $MoThC_2$ in ThC_2, Rh in ThC_2, and BaC_2 in ThC_2, and the melting point of BaC_2-graphite mixtures. (J.R.D.)

5576 AECU-4549

Massachusetts Inst. of Tech., Cambridge.

PHYSICAL METALLURGY OF UNCOMMON METALS. John T. Norton and Robert E. Ogilvie. Oct. 15, 1959. 25p. Contract AT(30-1)-981. OTS.

The solid solubility limits of the miscibility gap in the U-Nb phase diagram were determined between 800 and 1000°C by analysis of diffusion couples using an electron microbeam probe technique. The feasibility of using x-ray-diffraction methods to measure residual stresses in U and Zr (Zircaloy-2) was investigated. The magnetic properties of hematite ($\alpha-Fe_2O_3$) were investigated. The crystal structures of Y_5Si_3 and Y_5Ge_3 are being investigated. The structural relationships in the pseudo binary system $ZrFe_2-ZrCr_2$ were studied. (W.L.H.)

5577 ANL-5611

Argonne National Lab., Lemont, Ill.

APPARATUS FOR MEASURING THE THERMAL CONDUCTIVITIES OF METALS. S. T. Zegler and M. V. Nevitt. Oct. 1959. 15p. Contract W-31-109-eng-38. OTS.

An apparatus has been constructed for measuring the thermal conductivities of metals and alloys in the range from 40 to 700°C. Measurements can be made with a precision of ±4% or better. Conductivity values are reported for Armco iron, Inconel, and a U-3% Fs alloy. (auth)

5578 ARDE(MX)-20/59

Gt. Brit. Armament Research and Development Establishment, Fort Halstead, Kent, England.

THE DYNAMIC COMPRESSION OF PERSPEX. J. S. Buchanan, H. J. James, and G. W. Teague. Apr. 1959. 24p.

High explosives were employed to generate intense shock waves in perspex and from the measurements made of the shock and free surface velocities the 'Hugoniot' equation of state was determined at 3 to 13×10^{10} dynes/cm^2. The results fit an equation of an inverted Bridgman type. Data on variation of pressure, and shock and particle velocity with perspex thickness are presented graphically. (auth)

5579 BMI-770

Battelle Memorial Inst., Columbus, Ohio.

MECHANICAL PROPERTIES OF ZIRCONIUM AND ZIRCONIUM-URANIUM ALLOYS CONTAINING TIN. A. D. Schwope, G. T. Muehlenkamp, and W. Chubb. Sept. 29, 1952. Decl. Nov. 20, 1959. 18p. Contract W-7405-eng-92. OTS.

The mechanical properties of a large number of zirconium alloys including tin-zirconium and tin-uranium-zirconium, were studied. Tensile tests were run at room

temperature, 500°F, and 600°F. Hot-hardness data were obtained from room temperature to 1600°F, with emphasis on the hot-rolling range. Creep and fatigue tests were run on the tin–zirconium alloys at 500°F. (auth)

5580 GEAP-3117

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.

BORIDES OF INTEREST FOR CONTROL MATERIALS. A. N. Holden. Jan. 29, 1959. 10p. Contract AT(04-3)-189. OTS.

Various boron compounds are discussed in relation to their properties as control materials for various types of reactors. The crystal structures of these compounds are presented along with other physical properties. (W.L.H.)

5581 HW-61077

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

HYDROGEN EFFECTS ON ZIRCALOY-2 TENSILE PROPERTIES. H. H. Burton. July 10, 1959. 48p. Contract W-31-109-Eng-52. OTS.

Results of an investigation of hydrogen effects on the tensile properties of Zircaloy-2 are presented. The hydrogen range studied was 10 to 5000 ppm at room temperature to 400°C. The mechanical properties studied were the ultimate and 0.2 per cent offset yield strength, total elongation and reduction in area at fracture, proportional elastic limit, and elastic modulus. It was found that the experimental procedure and the data collected did not permit conclusions regarding the latter two properties. (auth)

5582 NAVORD-5065

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

EFFECT OF RAPID HEATING AND COOLING ON THE HARDNESS AND STRENGTH OF 2014-T6 AND 7075-T6 ALUMINUM ALLOYS. W. K. Smith. Apr. 9, 1956. 11p. (NOTS-1420).

Specimens of 2014-T6 and 7075-T6 aluminum alloys, commonly used in rocket motor tubes, were heated at 165°F per second to various temperatures and air-cooled, simulating conditions encountered in the firing of a rocket. Hardness was measured immediately after and 100 hours after the heating and cooling cycle. A relationship was thus established from which maximum temperatures of local areas of the fired motor tubes can be estimated from hardness values. High-heating-rate yield strengths of these alloys were plotted on the same graphs with the hardness-versus-temperature curves. (auth)

5583 NP-8194

[General Electric Co. Research Lab., Schenectady, N. Y.]

EFFECT OF VACUUM CATHODIC ETCHING ON OXIDATION RATE OF URANIUM. J. B. Newkirk and W. G. Martin. [1957?]. 15p.

It was experimentally confirmed that a vacuum cathodic etching treatment greatly retards the oxidation of a polished surface of uranium in air at room temperature. Electron-diffraction experiments led to the tentative conclusion that this effect is due to the formation of a protective layer of amorphous uranium oxide on the surface of the metal. (auth)

5584 ORO-225

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

MONTHLY LETTER REPORT NO. 12 COVERING THE PERIOD FROM OCTOBER 15 TO NOVEMBER 15, 1959. J. D. Fleming. Nov. 25, 1959. 2p. Project No. B-153. Contract AT(40-1)-2483. OTS.

Test firings of the ¼-inch diameter D tensile test specimens were continued. Firings were made at 2200°F for 2, 4, and 8 hours. The bars were about 80% stronger than the ½-inch bars reported in progress report No. 1 fig. 4 (ORO-209). Comparison firings are being made over a wide range of variables. Tests of a cast silica furnace are in progress. The furnace was operated at 2500°F for 30 minutes. Data from test runs at 2150°F indicate that the tensile strength of ¼-inch specimens is about twice that at room temperature. Firings for statistical study of procedures were completed and an analysis of results was started. Casting studies were begun on pottery plasters, and methods of analysis for cristobalite are being investigated. (J.R.D.)

5585 WADC-TR-59-223

Case Inst. of Tech., Cleveland.

RESEARCH ON STRAIN AGING EFFECTS IN TITANIUM. Harold S. Gurev and William M. Baldwin, Jr. June 20, 1959. 68p. Project No. 7351. Contract AF33(616)-5691. OTS.

The effects of varying interstitial element content (oxygen, carbon, and nitrogen) on the tensile properties of an alpha-beta titanium alloy, Ti-140A, were determined at test temperatures ranging from room temperature to above 1000°F and at strain rates from 0.05 to 19,000 in./in./min. The stress rupture properties of such alloys and similar interstitial bearing modifications of an alpha alloy, A-110AT, were also determined at 400 to 1000°F. The tensile properties of the alpha-beta modifications were strongly dependent on the nitrogen content alone, while the appearance of a strain rate dependent high temperature embrittlement in an alloy modification heat was governed by the identity of the principal interstitial present. (auth)

5586 WAL-TR-405.2/5

Watertown Arsenal Lab., Mass.

ELEVATED TEMPERATURE CHARACTERISTICS OF THREE AGE HARDENED AND INTERNALLY OXIDIZED TITANIUM–COPPER–CERIUM ALLOYS (thesis). Joseph M. Dhosi. Dec. 1959. 57p. DA Project No. 5B93-32-003. OTS.

Submitted to the Massachusetts Inst. of Tech., June 1959.

The effects of solid solution strengthening by zirconium and tantalum on the precipitation hardening response of Ti–2.0% Cu–0.4% Ce were determined. Aging curves and stress rupture curves at 316 to 649°C are presented for various conditions of heat treatment. Tensile data at room temperature and 538°C are tabulated. Internal oxidation on each of the alloys was performed and weight gain curves for the oxidation of recrystallized specimens at 650°C are included. Stress rupture data for 538°C testing of internally oxidized sheet specimens are plotted. Elevated temperature characteristics after aging and after internal oxidation were compared and it was found that the beneficial effects of each treatment are not additive. Internal oxidation was observed to improve the temperature stability of the base alloy. (auth)

5587 CEA-tr-R-209

INFLUENCE DES IMPURETÉS SUR LA CONDUCTIBILITÉ ÉLECTRIQUE ET LE CARACTÈRE NON-LINÉAIRE DES CARBORUNDUMS. (Effects of Impurities on the Electric Conductivity and Non-linear Character of Carborundums). L. I. Ivanov and V. I. Pruzhinina-Granovskaya (Proujinina-Granovskaia). Translated into French by B. de Trezvinsky from Zhur. Tekh. Fiz. 26, 220-31(1956). 23p.

A method is described for estimating the nonlinearity of the resistance of powder semiconductors having a non-

linear volt-ampere characteristic. This nonlinearity is explained in terms of the granulometric composition and pressure. A study was then made of the effects of additions on the electric conductivity and nonlinearity of carborundum. (T.R.H.)

5588 CEA-tr-X-118

CONSTANTES OPTIQUES DE LA SURFACE D'UN ACIER. (Optical Constants of the Surface of a Steel). H. Morokuma, Y. Miyasita, and H. Hasunuma. Translated into French by [S. S.] Minn from Ôyô Butsuri 26, 534-8(1957). 16p.

Light reflected from a metallic surface undergoes a fractional phase retardation which can be calculated from the optical constants n and k of the metal. These constants vary with the composition and state of the surface of the metal. A method is described for systematically modifying the state of a steel surface and measuring the ellipticity of the reflected light by means of a polarizing spectrometer to calculate n and k and their variations. (T.R.H.)

5589 HW-tr-9

MECHANICAL BEHAVIOR OF URANIUM. (Comportement Mécanique de L'uranium). J. Bernard and G. Coureau. Translated by Liz Appleby (Hanford Atomic Products Operation) from report CEA-693, 1957. 22p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 4694.

5590 NAA-SR-Memo-4205

RELATIONS BETWEEN ALLOTROPIC TRANSFORMATIONS AND SUB-STRUCTURES IN URANIUM. P. Lacombe. Translated by D. Kramer (Atomics International Div.) from p.11-20 of "Symposium on Special Metallurgy, held at Saclay, June 27–28, 1957." 14p. JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2241.

5591 NP-tr-330

HYDRODYNAMICS OF MOLTEN METALS. (Proceedings of the First Conference on the Theory of Casting Processes). (Gidrodinamika Rasplar Lennykh Metallor). (Trudy Pervogo Soveshchaniya po Teorii Litenynykh Protsessor). L. I. Fantalov and B. B. Gulyaeev (Gulyayev), eds. Translated from a publication of the Publishing House of the Academy of Sciences, Moscow. 1958. 384p. OTS.

Results of theoretical and experimental research on the dynamics of molten metals are presented. The viscosity properties of molten metals are examined along with the relationship of the liquid phase and the metallic aggregate formed from it. Metal flow in conduits, the causes of defects in castings, the effects of aluminum on steel, the relationship between the structural diagram of molten metal and its mechanical properties, and theoretical problems are also considered. (J.R.D.)

5592

PERMANENT MAGNETS AT HIGH TEMPERATURES. M. McCaig (Permanent Magnet Assn., Sheffield, Eng.). Cobalt No. 5, 26-8(1959) Dec. (In English)

The results of several workers on total and irreversible demagnetization of permanent magnets of varying composition at 300 to 500°C are compared. The anisotropic alloys containing 25 wt.% cobalt can be safely used up to 500°C. (C.J.G.)

5593

EXISTENCE OF A TRANSITORY SOFTENING DURING ISOTHERMAL EVOLUTION OF TEMPERED Al–Zn SOLID SOLUTIONS. Pierre Gobin and Jean Montuelle (Centre National de la Recherche Scientifique, [Paris]). Compt. rend. 249, 2554-6(1959) Dec. 9. (In French)

A study was made of the hardness versus time of Al–Zn solid solutions tempered and aged at ambient temperature. A transitory softening was observed. The phenomenon appears to be due to point defects introduced by the tempering. (tr-auth)

5594

EFFECTS OF CRYSTALLOGRAPHIC ORIENTATION ON INTERGRANULAR ATTACK OF PURE ALUMINUM BICRYSTALS. Claude Goux (Centre d'Études de Chimie métallurgique, Paris). Compt. rend. 249, 2557-9(1959) Dec. 9. (In French)

Pure Al bicrystals were electrolytically polished and subjected to a 1:1:1 mixture of $HCl-HNO_3-H_2O$. The joint planes of these crystals had a common crystallographic axis in their two lattices; the joint plane was approximately the plane of symmetry. The attack was not perceptible for the (111) faces and was progressively accentuated as one passed to the (100), (110), and (211) planes. The intensity of attack varies inversely with the reticular density of the plane observed. The apparent anisotropy of the joint suggests the presence of amorphous or imperfectly crystallized matter in the intergranular region. (T.R.H.)

5595

STUDY BY NEUTRONS OF THE TEXTURE OF UNPOLISHED URANIUM RODS DRAWN IN THE α PHASE. Jacqueline Laniesse, Marcel Englander, and Pierre Mefiel. Compt. rend. 249, 2576-8(1959) Dec. 9. (In French)

A neutron-scattering technique was used to study the texture of U drawn in the α phase. The samples, 5.4 ml volume, were cylindrical with the axis in the direction of drawing and coinciding with the axis of a monokinetic neutron beam (λ = 1.143A). The results are given and briefly discussed. (T.R.H.)

5596

RECENT RESEARCH ON THE OXIDATION OF METALS AT HIGH TEMPERATURES. J. Benard. Ind. chim belge 24, 1328-31(1959) Nov. (In French)

Several years' work in surface oxidation of metals by gases at high temperatures and low pressures is reviewed. (T.R.H.)

5597

INFLUENCE OF MODIFYING ADMIXTURES ON MECHANICAL PROPERTIES OF FOUNDRY STEEL. M. P. Braun. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 59-65(1959) July-Aug. (In Russian)

The influence of admixtures of Nb, Se, Ti, V, and Zr on the mechanical properties of chromium–manganese, silicon–manganese, and chromium–manganese–silicon steels was studied. (R.V.J.)

5598

HEAT-RESISTANCE OF Fe–Cr–Al ALLOY NO. 2 AT 600 TO 1200°. V. S. Mikheev. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 66-72(1959) July-Aug. (In Russian)

The heat-resistance properties of iron alloys with 23 to 27% Cr, 4.5 to 6.5% Al, and 0.5% Ti were investigated under various bend stresses at 600 to 1200°C. (R.V.J.)

5599

HIGH-TEMPERATURE CREEP IN NICKEL SOLID SOLUTIONS. K. A. Osipov and T'ien Te-Ch'eng (Metallurgical Inst. of the Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 77-81(1959) July-Aug. (In Russian)

The effects of alloying elements on the heat-resistance and creep parameters of solid solutions of nickel were studied in binary alloys with Cr, Fe, Mo, Ta, Ti, V, and W at 850 to 1000°C. (R.V.J.)

5600

PROPERTIES AND TREATMENT OF ALNICO TYPE ALLOYS. Ya. M. Dovgalerskii and E. I. Sokolovskii. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 99-105(1959) July-Aug. (In Russian)

The effects of alloying elements and heat treatment on the mechanical and magnetic properties of Alnico-3 type alloys (10% Al, 18% Co, 19% Ni, bal. iron) with admixtures of S, Ti, Ta, Nb, Be, and Pb were studied. (R.V.J.)

5601

ON THE HEAT-RESISTANCE THEORY AND DEVELOPMENT OF NEW HEAT-RESISTING TITANIUM ALLOY. I. I. Kornilov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 4, 190-9(1959) July-Aug. (In Russian)

Physico-chemical problems in heat-resistance studies and regularities in heat-resistance variations due to the character of chemical diffusion of metals are discussed. (R.V.J.)

5602

SPECTROSCOPIC STUDIES OF ELECTRO-ERODED OXYGEN CONTAINING TITANIUM. I. S. Sventitskiĭ and K. I. Taganov. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1097-9(1959) Sept. (In Russian)

The spectra of electric discharges from Ti electrodes were investigated to establish the dependence of electro-erosion on oxygen content. The results were then compared to results from analyses of deposits from the discharges. Specimens tested varied in oxygen content from 0.12 to 2.32%. The spectral studies indicated no relationship between erosion and oxygen content, however, analyses of deposits indicated a definite dependence. (R.V.J.)

5603

ELASTIC CONSTANTS OF SINGLE CRYSTAL BERYLLIUM. J. F. Smith and C. L. Arbogast (Iowa State Univ. of Science and Technology, Ames). J. Appl. Phys. 31, 99-102(1960) Jan.

The five independent elastic constants of beryllium were determined with the pulse echo technique at a frequency of 10 Mc/sec. The values extrapolated to 0°K are $C_{11} = 29.94 \pm 0.06$, $C_{33} = 34.22 \pm 0.12$, $C_{44} = 16.62 \pm 0.05$, $C_{12} = 2.76 \pm 0.08$, $C_{13} = 1.1 \pm 0.5$ in units of 10^{11} dyne/cm^2. Voigt averaging and Reuss averaging of the single crystal elastic constants give excellent agreement because of the small magnitude of the nondiagonal elements, C_{12} and C_{13}. The averaged values compare favorably with previous data from polycrystalline beryllium. (auth)

5604

MAGNETIZATION OF THE COMPOUND TiFe. M. V. Nevitt (Argonne National Lab., Lemont, Ill.). J. Appl. Phys. 31, 155-7(1960) Jan.

Magnetization curves were determined for the CsCl-type compound TiFe at six temperatures ranging from 9°K to 110°K. The curves show a saturation effect at high field strength but they are of a form that is not characteristic of ferromagnetism. A saturation magnetization of 3.30 ± 0.07 cgs units per gram was derived from the high field data. This moment is tentatively interpreted as resulting from a small concentration of uncompensated spins produced by disorder in the CsCl-type lattice. The electrical resistance of samples of TiFe was measured over the temperature range from 10°K to room temperature. Magnetization measurements were attempted on the CsCl-type compounds TiCo and TiNi, but their magnetizations were too small to be detected. (auth)

5605

SPONTANEOUS MAGNETIZATIONS OF SOME GADOLINIUM ALLOYS. Sigurds Arajs and D. S. Miller (U. S. Steel Corp. Research Center, Monroeville, Penna.). J. Appl. Phys. 31, 213-15(1960) Jan.

The spontaneous magnetization of Gd–Y and Gd–La alloys was measured at various at. % of yttrium and lanthanum. Curves were plotted of the spontaneous magnetization as a function of temperature in order to obtain values in the region near the ferromagnetic Curie point. It was found that in the region near the Curie temperature the square of the spontaneous magnetization is linear in 1/T. (B.O.G.)

5606

THERMIONIC PROPERTIES OF URANIUM. E. G. Rauh and R. J. Thorn (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 31, 1481-5(1959) Dec.

Thermionic measurements were made on uranium metal in the form of drawn wire and on films of uranium deposited on tungsten by evaporation in ultrahigh vacua. Measurements of the emission current as a function of accelerating potential and of the work function of the bulk material indicated that the surface was never completely freed of oxide. Measurements of the work function and emission constant A as a function of the thickness of the evaporated films showed both ϕ and A to increase with increasing depth of deposit up to 15 atom layers and to reach constant values of 3.47 ± 0.03 ev and 114 ± 12 amp cm^{-2} deg^{-2}, respectively, for deposits 15 to 200 atom layers deep. Qualitative measurements of the ionization potential of uranium by means of surface ionization showed the positive ion current to increase with increasing temperature indicating the ionization potential to be greater than 4.53 ev. The magnitude of the positive ion currents suggested an ionization potential of 4.5 to 5.0 volts. (auth)

5607

CRYSTAL STRUCTURE OF β-Hg. Masao Atoji, J. E. Schirber, and C. A. Swenson (Iowa State Univ., Ames). J. Chem. Phys. 31, 1628-9(1959) Dec.

The crystal structure of β-Hg, a pressure induced modification of mercury which is the stable form below 79°K, was determined. Whereas ordinary (α) mercury crystallizes in a simple rhombohedral lattice, β-Hg is found to be a body-centered tetragonal with $a = 3.995$ A, and $b = 2.825$ A at 77°K. Both phases are superconductors. A brief description of the low temperature x-ray cryostat and camera is given. The relation of α-Hg and β-Hg to Pauling's resonating valence bond theory of metals is discussed. (auth)

5608

HIGH-TEMPERATURE ALLOYS IN THE U.S.S.R. A. G. Guy (Baikov Inst. of Metallurgy, Moscow). Metal Progr. 77, 82-6(1960) Jan.

On a five-component nickel-base alloy containing 20 wt.% Cr, 6 wt.% W, 4.5 wt.% Al, and 0 to 9 wt.% Ti, it was found that the Ti content at which the diffusion rate was a minimum shifted from 3% at 955°C to 0.5% at 1250°C. From rupture testing low-carbon steels of 0.15 to 2.0 mm in diameter it was found that both the time to rupture and amount of deformation at rupture for a given stress decreased appreciably for diameters less that 1.0 mm. It was concluded that microspecimens cannot be employed to obtain creep and rupture data applicable to machine parts of normal size. (C.J.G.)

5609
CLAD TITANIUM-BASE DISPERSIONS CONTAINING BORON. E. S. Byron, F. O. VonPlinsky, and S. W. Porembka (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 6, 361-70(1959) Nov.

A study was undertaken to evaluate Zircaloy-2 clad titanium-base dispersions containing enriched boron or enriched titanium diboride as possible control materials. Results of corrosion tests of the nonirradiated dispersions indicated that cladding with a corrosion resistant material was necessary. Roll bonding Zircaloy-2 cladding to titanium-base dispersions was shown to be feasible through a study of the integrity, corrosion resistance, and bend properties of the clad dispersions. Clad separation and excessive swelling were noted in the samples of clad titanium-base dispersions containing 5 wt.% enriched boron which were irradiated for long exposures. The clad 34 wt.% enriched titanium diboride dispersion irradiated to nearly the same exposures showed no visual evidence of clad cracking or excessive swelling. Metallographic examination after irradiation, which was confined to the 5 wt.% enriched boron dispersion, revealed internal cracking and bond line damage with the severity of damage increasing with increasing irradiation exposure. (auth)

5610
THE MAGNETIC SUSCEPTIBILITY OF VANADIUM BETWEEN 20 AND 293°K. B. G. Childs, W. E. Gardner, and J. Penfold (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 4, 1126-30(1959) Oct.

The magnetic susceptibility of four samples of pure vanadium metal, prepared by different methods, was measured at 20, 77, and 293°K. The most reliable values obtained are 5.89, 5.88, and 5.81×10^{-6} emu/g, respectively. There appears to be no systematic dependence of susceptibility on the method of preparation but the values obtained are appreciably larger than those reported by previous workers. The reason for this difference is discussed in terms of the impurity contents of the vanadium used in the earlier work. (auth)

5611
NEUTRON STUDY OF THE CRYSTAL AND MAGNETIC STRUCTURES OF $MnFe_{2-t}Cr_tO_4$. Stanley J. Pickart (U. S. Naval Ordnance Lab., White Oak, Md.; Brookhaven National Lab., Upton, N. Y.; and Univ. of Maryland, College Park) and Robert Nathans (Pennsylvania State Univ., University Park and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 317-22(1959) Oct. 15.

Powder neutron diffraction measurements were performed at temperatures down to 4.2°K on three compositions in the mixed spinel series $MnFe_{2-t}Cr_tO_4$ ($0 \leq t \leq 2$). Separation of the nuclear and magnetic scattering was accomplished both by applying an external field and by measuring the neutron intensities above the Curie temperature. Analysis of the nuclear scattering indicates that all the compounds investigated have essentially the normal spinel structure, the fraction of divalent atoms on the tetrahedral sites being about 0.8, 0.9, and 1.0 for $t = 0.5$, 1.0, and 1.5, respectively, while in every case the Cr atoms are located on the octahedral sites. The magnetic scattering is consistent with antiparallel A- and B-site moments, with no evidence being found for ordered triangular configurations. The magnitude of the A-site moments in each instance is approximately the moment value of the cations located there, while the B-site moments are significantly lower than expected on this basis. These results can be attributed to the occurrence within the B sublattice of spinquenched cations, random antiparallel spins, or short-range ordered triangular configurations, since any of these alternatives lowers the sublattice moment on the average. (auth)

5612
THE PRINCIPAL g VALUES OF YTTERBIUM IONS IN YTTRIUM ACETATE, A TRICLINIC CRYSTAL. J. G. Park (Univ. of Oxford). Proc. Phys. Soc. (London) 74, 513-16(1959) Nov. 1.

The principal g values of ytterbium ions in yttrium acetate were determined by a method which requires that the single crystal specimen can be rotated about a horizontal axis inside the cavity of a paramagnetic resonance apparatus, as well as the more usual requirement that the horizontal magnetic field can be rotated about a vertical axis. By this method the principal g values are measured directly when they are located, whereas in other methods that have been proposed they are calculated from measurements of certain g values and angles. The orientation of the g tensor was not determined, but a method for finding it is outlined. The results were (choosing x, y, z so that $g_x > g_y > g_z$) $g_x = 4.583 \pm 0.008$, $g_y = 2.117 \pm 0.004$, and $g_z = 0.71 \pm 0.03$. (auth)

5613
AN ANALYSIS OF THE SOFT X-RAY EMISSION SPECTROSCOPY OF GRAPHITE AND AN APPROPRIATE ELECTRONIC PICTURE OF IT. A. K. Dutta (Indian Ass'n. for the Cultivation of Science, Calcutta). Proc. Phys. Soc. (London) 74, 604-8(1959) Nov. 1.

From an analysis of the soft x-ray emission spectra of graphite, it is deduced that the fundamental Brillouin zone of graphite is bounded by two independent sets of planes, the electrons overlapping one such set into the next zone, and that the total band width is about 24(±3) ev. On comparing these results with the properties of the three Brillouin zones which have been suggested for graphite, namely the 1-, 3-, and 4-electron zones, the last is found to be the most suitable. It is also shown that the K-value for the vertical bounding planes of the four-electron zone corresponds to the energy difference between the origin and the first peak of the soft x-ray spectra, and that there is sufficient σ-π interaction in the C–C bond formation to make the four-electron zone plausible. (auth)

5614
ON THE HIGH-TEMPERATURE COMPATIBILITY OF CESIUM GAS WITH SOME DIELECTRICS. Paul Wagner and Sam R. Coriell (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 30, 937-8(1959) Oct.

Eight refractory dielectrics were exposed, under controlled conditions, to cesium gas at temperatures as high as 1475°C. The apparatus designed for this work and results of this investigation are discussed. (auth)

5615
ZINC–ZIRCONIUM SYSTEM. P. Chiotti and G. R. Kilp (Ames Lab., Ames, Iowa). Trans. Met. Soc. AIME 215, 892-8(1959) Dec.

Thermal, metallographic, vapor pressure, and x-ray data were obtained to establish the phase diagram for the zinc-zirconium system. Five compounds corresponding to the stoichiometric formulas ZrZn, $ZrZn_2$, $ZrZn_3$, $ZrZn_9$, and $ZrZn_{14}$ were observed. All these compounds, with the exception of $ZrZn_2$, which melts congruently at 1180°C under constrained zinc-vapor conditions, undergo peritectic reactions. The temperature at which the zinc vapor pressure is 1 atm for a series of alloys was determined from vapor-pressure measurements. The data obtained are summarized in the construction of a 1-atm-pressure phase diagram and a phase diagram corresponding to a pressure of less than 10 atm. (auth)

5616

SOME EFFECTS OF ALLOYING ON THE STRENGTH PROPERTIES OF COLUMBIUM AT ELEVATED TEMPERATURES. Gordon D. Gemmell (E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.). Trans. Met. Soc. AIME 215, 898-901(1959) Dec.

Effects of solid-solution alloying with titanium, molybdenum, and tungsten up to 10 wt.% solute on the strength of pure niobium at elevated temperatures (mainly 2000°F) were investigated by means of creep-rupture, hot-tensile, and hot-hardness testing and recrystallization studies. (auth)

5617

HOT INDENTATION TESTING OF MAGNESIUM AND OTHER SELECTED MATERIALS. J. W. Goffard and R. G. Wheeler (General Electric Co., Richland, Wash.). Trans. Met. Soc. AIME 215, 902-4(1959) Dec.

The Larson-Miller parameter was used to correlate time, temperature, and indentation creep of magnesium, aluminum, and some of their alloys. In the temperature range 300 to 450°C, the short-time Meyer hardness of pure magnesium was less than that of the magnesium alloys tested, but for long times the pure magnesium has greater indentation creep resistance. Aluminum (1100 alloy) had 1.5 to 2.5 times more indentation creep resistance than magnesium at 300 and 450°C, respectively. Hardening of aluminum with a dispersion of Al_2O_3 was effective in the time and temperature ranges studied. (auth)

5618

ALLOYS OF COPPER, NICKEL, AND TANTALUM. Cyril Stanley Smith (Univ. of Chicago). Trans. Met. Soc. AIME 215, 905-9(1959) Dec.

The solubility of tantalum at 1100°C is 0.025 wt.% in pure copper, 1.2 wt.% with 20 wt.% Ni, and 2.7 wt.% with 30 wt.% Ni. The solubility decreases with temperature, and the alloys are precipitation hardenable. A 79/20/1 Cu-Ni-Ta alloy reaches maximum hardness after aging at about 750°C and, if cold worked, does not recrystallize below that temperature. The alloys exhibited good tensile properties at moderately elevated temperatures and can be hot and cold worked nearly as easily as cupronickel. (auth)

5619

THE EFFECTS OF VARIATIONS IN NITROGEN AND MANGANESE CONTENT ON THE STRUCTURE AND HIGH-TEMPERATURE PROPERTIES OF CAST X-40 ALLOY. E. E. Fletcher and A. R. Elsea (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 215, 917-25 (1959) Dec.

Cast X-40 alloy with a 0.010 wt.% nitrogen content had a 100-hr rupture stress at 1500°F of about 28,200 psi. Increases in nitrogen content progressively decreased the rupture strength, and with about 0.09 to 0.15 wt.% N, a minimum strength of 25,600 psi was reached, but there was no accompanying change in microstructure. Further increases in nitrogen resulted in the formation of progressively increasing amounts of a lamellar, pearlitic-type structure at the grain boundaries, with accompanying increases in rupture strength. At about 0.25 to 0.33 wt.% N, the rupture strength was 29,100 psi. Two series of melts representing different melting stocks exhibited minimum rupture strengths at different nitrogen contents. This suggests that some unidentified trace element not removed by vacuum melting has a strong influence on the response of this alloy to variations in nitrogen content. In a series of melts with manganese contents ranging from 0.6 to 3.2 wt.%, the material with the lowest manganese content had the highest 100-hr rupture strength at 1500°F. The manganese variations had no appreciable effect on the microstructure. (auth)

5620

SUBGRAIN GROWTH AND SOFTENING IN ROLLED ALUMINUM CRYSTALS. Paul A. Beck, B. G. Ricketts, and A. Kelly (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 215, 949-53(1959) Dec.

The isothermal kinetics (at 200 to 400°C) of subgrain growth and softening were studied in a 99.997% pure Al crystal rolled to 80% in the (1 1 0)[1 $\bar{1}$ 2] orientation under conditions where recrystallization did not take place. It was found that the kinetics of subgrain growth and of softening were similar in that both varied linearly with the logarithm of time, and that the correlation between subgrain growth and softening was in first approximation independent of the annealing temperature. (auth)

5621

HIGH-TEMPERATURE AGING STRUCTURES IN γ'-HARDENED AUSTENITIC ALLOYS. W. C. Hagel (General Electric Co., West Lynn, Mass.) and H. J. Beattie, Jr. (General Electric Co., Schenectady, N. Y.). Trans. Met. Soc. AIME 215, 967-76(1959) Dec.

Variations in the secondary phase reactions of six nickel- and cobalt-base alloys were determined as a function of solutioning from 1700 to 2200°F and aging at 1200 to 1800°F for times up to 1000 hr. Room-temperature impact energies and hardnesses were also measured. Precipitation hardening of these alloys results mainly from the grain-interior formation of γ'; $M_{23}C_6$ appears principally as grain-boundary cells which can be eliminated by intermediate high-temperature aging treatments. Cellular precipitation of γ' occurs up to 1500°F in cobalt-nickel alloys devoid of chromium, where precipitation by this mode can be attributed to a large degree of lattice disregistery. (auth)

5622

CLOSE-PACKED ORDERED STRUCTURES IN BINARY AB_3 ALLOYS OF TRANSITION ELEMENTS. Austin E. Dwight (Argonne National Lab., Lemont, Ill.) and Paul E. Beck (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 215, 976-9(1959) Dec.

A search was made for ordered phases of AB_3 composition in various combinations of Ti- and V-group elements with Co- and Ni-group elements. Three new $TiNi_3$-type phases ($ZrPd_3$, $HfPd_3$, and $HfPt_3$) were found. Twelve new Cu_3Au-type phases ($TiRh_3$, $TiIr_3$, $ZrRh_3$, $ZrIr_3$, $HfRh_3$, $HfIr_3$, VRh_3, VIr_3, $CbRh_3$, $CbIr_3$, $TaRh_3$, and $TaIr_3$) were found. The lattice contraction for all three structures considered increases with increasing relative size of the A atom, suggesting that it is mostly the A atom that contracts. It was noted that, for the same radius ratio the lattice contraction is larger when the A atom is Ti than if it is Cb or Ta. (auth)

5623

PRECIPITATION PHENOMENA IN COBALT–TANTALUM ALLOYS. M. Korchynsky and R. W. Fountain (Union Carbide Metals Co., Niagara Falls, N. Y.). Trans. Met. Soc. AIME 215, 1033-43(1959) Dec.

The precipitation phenomena occurring in cobalt-tantalum alloys were investigated in the temperature range from 500 to 1050°C by correlating the results of metallographic, X-ray, micro- and macrohardness, and electrical resistivity studies. The property changes were found to depend on general precipitation and lamellar precipitation. Two new intermetallic phases, α Co_3Ta, a metastable ordered face-centered-cubic compound, and a stable β Co_3Ta phase of hexagonal structure were identified. The

previously reported Co_2Ta phase was found to exist in two allotropic modifications, the hexagonal $MgZn_2$-type and the cubic $MgCu_2$-type Laves phases. (auth)

5624

SHORT-TIME CREEP-RUPTURE BEHAVIOR OF TUNGSTEN AT 2250° TO 2800°C. Walter V. Green (Los Alamos Scientific Lab., N. Mex.). Trans. Met. Soc. AIME 215, 1057-60(1959) Dec.

The creep-rupture behavior of a powder-metallurgy tungsten rod is reported for temperatures of 2250, 2500, 2700, and 2800°C, stresses up to 7000 psi, and times up to 4 hr. The temperature dependence and the stress dependence of creep rates are evaluated. Rupture time is fitted to the Larson-Miller parameter and compared to lower-temperature and higher stress results reported by Pugh. (auth)

5625

SHORT-TIME CREEP-RUPTURE BEHAVIOR OF MOLYBDENUM AT HIGH TEMPERATURES. W. V. Green, M. C. Smith, and D. M. Olson (Los Alamos Scientific Lab., N. Mex.). Trans. Met. Soc. AIME 215, 1061-6(1959) Dec.

The creep-rupture behavior of a powder-metallurgy molybdenum rod is reported in the temperature range 1600 to 2500°C, at stresses up to 9000 psi and times up to 1 month. The effects of temperature, stress, and grain growth are discussed. Rupture time is fitted to the Larson-Miller parameter and compared to lower-temperature and higher-stress results reported by Pugh. (auth)

5626

OBSERVATIONS ON THE SYSTEM ZIRCONIUM IRON. L. E. Tanner (Republic Aviation Corp., Farmingdale, N. Y.) and D. W. Levinson (Armour Research Foundation, Chicago). Trans. Met. Soc. AIME 215, 1066-7(1959) Dec.

The solubility of iron in zirconium was determined to be between 0.017 and 0.025 wt.% in the α-phase. The observation of fine $ZrFe_2$ particles in a specimen of 0.012 wt.% Fe alloy quenched from 700°C indicates that the solubility drops below this composition at 700°C and lower. A single-phase $ZrFe_2$ x-ray diffraction pattern from an alloy of 54.81 wt.% Fe was observed with a melting point of 1650° melting points for 47.42 and 49.82 wt.% Fe alloys were determined to be 1590 and 1640°C respectively. (C.J.G.)

5627

SLIP MARKINGS AND PLASTIC INSTABILITY OF CRYSTALS. Robert L. Fleischer (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME 215, 1067-8(1959) Dec.

It is suggested that plastic instability contributes to the coarse slip observed in hardened but low-hardening single crystals and the concentration of slip into bands in the case of nonhardening, constant strain-amplitude fatigue. (auth)

5628

CREEP-RUPTURE TESTS AT 1800° AND 2000°F ON HYPER-PURE SILICON POLYCRYSTALS. Jack T. Brown (Westinghouse Electric Corp., Pittsburgh). Trans. Met. Soc. AIME 215, 1068-9(1959) Dec.

The creep-rupture behavior of silicon polycrystals is reported at 1800 and 2000°F, at stresses up to 9500 psi and times up to 458 hr. The stress to rupture in 100 hr at 2000°F is between 8000 and 9000 psi. (C.J.G.)

5629

NOTE ON THE EXISTENCE OF "$UTa_{10}C_4$." Erwin Parthé (Massachusetts Inst. of Tech., Cambridge) and J. Paul Pemsler (Nuclear Metals, Inc., Concord, Mass.). Trans. Met. Soc. AIME 215, 1070-1(1959) Dec.

X-ray-diffraction patterns of "$UTa_{10}C_4$" as reported by Schramm et al. were compared to Ta_2C. It is concluded that no ternary compounds occur in the section TaC–UC–U–Ta of the ternary system Ta–U–C. The phase Ta_2C with a C27 structure extends into the ternary system; therefore "$UTa_{10}C_4$" is a uranium-enriched Ta_2C. (C.J.G.)

5630

DEFORMATION MODES OF YTTRIUM AT ROOM TEMPERATURE. E. J. Rapperport (Nuclear Metals Inc., Concord, Mass.) and C. S. Hartley (Wright Air Development Center, Wright-Patterson AFB, Ohio). Trans. Met. Soc. AIME 215, 1071-2(1959) Dec.

The deformation modes of yttrium (2170 ppm of oxygen and 1340 ppm of titanium as major impurities) were studied at room temperature. The predominant slip plane was $[1\,0\,\bar{1}\,0]$ and the most active twin plane was $[1\,0\,\bar{1}\,2]$. (C.J.G.)

5631

DIFFUSION OF METALS IN LIQUID LEAD. Erich Pelzel (Stolberger Zink AG, Stolberg, Ger.). Z. Metallk. 50, 649-51(1959) Nov. (In German)

In a trough-shaped lead melt the diffusion of metals was observed and melted by color changes of the surface oxidation layer. The diffusion-concentration relations found showed that under equal conditions the heat of mixing determines the rate of diffusion. (T.R.H.)

5632

DIFFUSION STUDIES IN THE URANIUM–ZIRCONIUM AND URANIUM–NICKEL SYSTEMS. Norbert Müller (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 652-60(1959) Nov. (In German)

Investigations of diffusion in the systems U-Zr and U-Ni are described. The occurrence of the Kirkendall effect in both systems leads to the idea that the diffusion acts according to mechanism of vacancy-diffusion. The results are discussed for U-Zr and U-Ni. With U-Ni all intermediary phases according to the equilibrium diagram occur during diffusion. (auth)

5633

TEMPERATURE BEHAVIOR OF THE ISOTOPE EFFECT IN CURRENT PASSAGE THROUGH LIQUID ALKALI METALS. A. Lodding (Chalmers Technische Hochschule, Göteborg). Z. Naturforsch. 14a, 934-7(1959) Nov. (In German)

The temperature dependence of the Haeffner effect was studied in K between 79 and 335°C. There was an increase in the mass effect (μ) up to ~250°C; above 300°C μ decreased however. These findings agree with earlier studies and through new measurements confirmed the behavior of Rb. (tr-auth)

5634

FORMATION OF CONTINUOUS SOLID SOLUTIONS IN PSEUDOBINARY SYSTEMS OF CrB_2–TiB_2. N. G. Sevast'yanov, V. A. Epel'baum, M. A. Gurevich, B. F. Ormont, and G. S. Zhdanov (Karpov Inst. of Physics and Chemistry). Zhur. Priklad. Khim. 32, 1941-4(1959) Sept. (In Russian)

Radiometric and chemical methods were used for determining the formation conditions of binary chromium and titanium diborides from $(Cr_{0.9}Ti_{0.1})B_2$ to $(Cr_{0.1}Ti_{0.9})B_2$ in vacuum at 2100 to 2200°C. A tendency to form continuous series of solutions with variations in the hexagonal lattice from a = 2.962 kX, c = 3.060 kX (for CrB_2) to a = 3.023 kX, c = 3.220 kX (for TiB_2) is indicated. Preparation of continuous series of solid solutions by complex boride synthesis with the initial diborides of CrB_2 and TiB_2 was

not successful. However, synthesis by hydrogen reduction of chromium titanium and boron oxides was quite successful. (R.V.J.)

Radiation Effects

5635 AECU-4564
Rensselaer Polytechnic Inst., Troy, N. Y.
EFFECT OF ATOMIC INTERACTION POTENTIAL ON DEFECT PRODUCTION IN METALS. E. Brown and G. H. Goedecke. [1959]. 11p. Contract AT(30-1)-1995. OTS.

The cascade of displaced atoms in metals, induced by high-energy radiation, was investigated, with the assumption of a screened coulomb interaction between atoms. The problem was treated stochastically on an IBM 650 electronic computer for several different models. The comparison of our results with those for which a hard sphere interaction was used shows only a slight decrease in the expected number of atomic displacements. (auth)

5636 AECU-4589
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
FISSION GAS GENERATION AND CONSEQUENT HIGH TEMPERATURE IRRADIATION EFFECTS ON NATURAL URANIUM, INCLUDING CREEP PROPERTIES. A Literature Search. Myra Scott. Dec. 15, 1959. 13p. OTS.

A search of foreign literature to determine the development status in the area of fission gas generation and its effects on natural U is reported. The sources which were examined are listed. 64 references. (J.R.D.)

5637 ANL-5918
Argonne National Lab., Lemont, Ill.
IRRADIATION OF EXTRUSION-CLAD URANIUM–2 w/o ZIRCONIUM ALLOY FOR EBR-I, MARK III. J. H. Kittel. Oct. 1959. 18p. Contract W-31-109-eng-38. OTS.

The fuel material specified for the Mark III core of EBR-I was uranium-2 wt.% zirconium alloy coextruded with Zircaloy-2 cladding. From previous work on swaged or rolled uranium-2 wt.% zirconium alloy, it was anticipated that the extruded alloy would be dimensionally unstable under irradiation unless stabilized by suitable heat treatment. In order to determine an effective heat treatment, irradiation studies were made on both clad and unclad extruded uranium-2 wt.% zirconium alloy specimens at irradiation temperature estimated at 200 to 750°C. The irradiation specimens included material with three different heat treatments, selected on the basis of previous studies, and material transient melted in its cladding. For unclad specimens, it was found that the irradiation temperature strongly influenced the various irradiation growth rates resulting from different heat treatments. Growth rates of the clad specimens were relatively insensitive to either irradiation temperature or prior heat treatment. An exception was the transient-melted material, which shortened under irradiation. The cladding had only limited ability to restrain the swelling rates of specimens irradiated at the more elevated temperatures. Clad transient-melted material was found to be most resistant to high-temperature swelling under irradiation. The results of the present study combined with observations in earlier investigations resulted in a recommendation that the reference heat treatment for the core consist of gamma solution at 800°C followed by isothermal transformation at 690°C. (auth)

5638 KAPL-M-ECH-1
Knolls Atomic Power Lab., Schenectady, N. Y.
LONG TERM IRRADIATION OF NATURAL HAFNIUM. E. C. Hansen. Dec. 15, 1959. 50p. Contract W-31-109-Eng-52. OTS.

Due to the importance of hafnium as a nuclear reactor material (control rods, burnable poisons), it is of general interest to calculate the isotopic population of natural hafnium and its irradiation products, as a function of time, for long germ irradiations. The isotopic population is presented for times $0 \leq t \leq 50{,}000$ hrs, thermal fluxes $10^{12} \leq \phi \leq 10^{14}$, and epithermal to thermal flux ratios $0 \leq A \leq 8$. The above is equivalent to depletion of zero to 99% depending upon the thermal flux level. The major limitation to the presented results is the assumption of infinite dilution, i.e., no spatial or energy self shielding. These results are thus applicable to such cases as the surface of control rods or distributed poisons. It is felt that the error in the presented results should be of the order of ±30%. (auth)

5639 NAA-SR-69
North American Aviation, Inc., Los Angeles.
ENERGY REQUIRED FOR ATOMIC DISPLACEMENTS IN GRAPHITE DETERMINED BY ELECTRON BOMBARDMENT. D. T. Eggen. Apr. 10, 1950. Decl. Oct. 7, 1959. 20p. OTS.

Graphite was bombarded with electrons of various energies ranging from 0.1 to 1.0 Mev. By measuring the change in electrical resistance produced by the irradiation, a threshold below which no radiation damage occurred was determined at 120 ± 5 kev. This is believed to indicate that the minimum energy required to produce a displacement of a carbon atom in the graphite lattice is 24.7 ± 0.9 ev. The measured variation in cross section for the atomic displacements as a function of electron energy above the threshold follows theoretical predictions. The variation in resistivity as a function of depth was determined in a thick graphite sample which was bombarded by 1.0 Mev electrons. The changes in electric resistivity during pulse-annealing to 2000°C indicated the disturbances in the graphite lattice produced by electron bombardment to be identical with those produced by cyclotron particles and neutrons. (auth)

5640 NP-8152
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ELECTRICAL CONDUCTIVITY CHANGES OF n-TYPE GERMANIUM BOMBARDED BY REACTOR FAST NEUTRONS. Report No. 101/I-B. B. Buras, H. Rzewuski, M. Bartenbach, and Z. Tomczak. Aug. 1959. 11p.

The electrical conductivity changes of n-type germanium bombarded by fast neutrons from a reactor were studied, and the position of the energy level in the forbidden band of the shallow traps (0.206 ev below the conduction band) caused by fast neutron bombardment was established. The results are in agreement with those of other workers obtained with germanium of higher conductivity and using a slightly different calculation approach. (auth)

5641 NP-8179
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST 30 [ON RADIATION EFFECTS DATA]. Dec. 15, 1959. 22p. Project No. 2133. Contract AF33(616)-6564.

5642 NP-8224
[Army Signal Engineering Labs., Fort Monmouth, N. J.].
NUCLEAR RADIATION EFFECTS ON ELECTRONIC MATERIALS AND COMPONENTS. Information Bulletin No. 268. Jan. 31, 1957. 34p.

A brief summary of unclassified data is presented on

radiation effects, originating from atomic explosions, reactors, and warheads, on electronic components and materials. Use of the data may lead to the answers of questions arising in relation to selection of components and materials for use in nuclear environments. The data are primarily concerned with the effects of neutrons and gamma radiation. 69 references. (J.R.D.)

5643 WADC-TN-59-365(Vol.III)

Marquardt Corp. Nuclear Systems Div., Van Nuys, Calif. PROJECT PLUTO TECHNICAL SUMMARY REPORT, "MATERIALS SECTION (TABLE LXXV)." (Including Fourteenth Quarterly Progress Report). Report No. 30002. Nov. 15, 1959. 153p. Contract AF33(616)-6214.

Two series of irradiation programs were conducted during 1959 to investigate the effects of the following combined environments on materials and components: (1) 300°F temperature, 10^{11} nv, and 10^{16} nvt; (2) 500°F temperature, 10^{11} nv, and 10^{16} nvt; (3) 100 to 150°F temperature, 10^{12} nv, and 10^{17} nvt; and (4) 3000°F temperature, 5×10^{13} nv, and 10^{19} nvt. Irradiations at the GTR under 1 and 2 included silicon semiconductor diodes, infrared sensors, ion chambers, and potting compounds. The irradiation environment consisted primarily of gamma photons and neutrons with energies greater than 0.48 ev. Two tests, each of 10-hr duration at 40 kw and 20-hr duration at 3 Mw were conducted. A separate test was run for 10 hr at 40 kw, and 12 hr at 3 Mw to determine the shielding properties of the potting compounds. A second series of tests, (3) and (4), was performed at the General Electric Testing Reactor which covered ceramic insulators, ceramic guide tubes, subminiature vacuum tubes, gallium arsenide semiconductor diodes, thermistors, high-temperature ion chambers, and silicon semiconductor reference diodes. A total of 10 tests was made during a 20-day operating cycle. (W.D.M.)

5644 WAPD-TM-159

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

RADIOCHEMISTRY OF THE PWR FUEL MATERIAL CYCLING TESTS (WAPD-29-1 AND -2) IN THE WAPD-29 VH-3 LOOP OF THE MATERIALS TESTING REACTOR. R. Ehrenreich. Nov. 1959. 21p. Contract AT-11-1-GEN-14. OTS.

The results of in-pile irradiation tests of PWR fuel materials with particular regard to the chemical and radiochemical aspects are reported. These tests were conducted to study the difference of fission product release from defected fuel specimens containing UO_2 fuel materials of two different specific densities; also, one test included a comparatively high oxygen concentration in the loop water to study the effect of an accidental oxygen addition on the rate of fission product release. No firm deduction could be drawn as to the effect of different fuel densities on the emanation of fission products from defected specimens, and the high oxygen concentration had practically no effect on the rate of fission product release. (auth)

5645

EFFECTS OF GAMMA RADIATION AT 25 C ON SILICONE DIELECTRICS. C. G. Currin (Dow Corning Corp., Midland, Mich.) Commun. and Electronics No. 44, 297-308(1959) Sept.

Radiation effects on the dielectric and physical properties of silicon fluids, compounds, elastomers, and resins were studied. The dielectric constant of all silicone dielectrics tested remained essentially the same during irradiation. Electric strength was unaffected. The dissipation factor of silicon fluids at 100 and 1000 cps may be 10 to 100 times normal when irradiated at a dose rate of 0.1 M rad per hr. The resistivity is affected in the same manner. The fluids, elastomers, and resins tested were found to be practical and useful for doses up to 100, 200 to 500, and 1000 Mrad, respectively. (C.J.G.)

5646

THE EFFECT OF THE IRRADIATION OF GERMANIUM WITH α PARTICLES ON THE RECOMBINATION OF CURRENT CARRIERS. Gerhard Dorda (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 181-5(1958). (In English)

A study was made of the effect of irradiation with α particles on surface recombination on germanium. An approximative evaluation of the results showed that the position of the energy level of the recombination center produced by irradiation lies near the upper edge of the valence band or the lower edge of the conduction band. A value of roughly 3×10^{-12} cm^2 was obtained for the effective recombination surface produced by the absorption of one α particle. (auth)

5647

THE EFFECT OF NUCLEAR RADIATION ON JET FUELS. A. C. Nixon, R. E. Thorpe, and H. B. Minor (Shell Development Co., Emeryville, Calif.). Ind. Eng. Chem. 52, 47-50 (1960) Jan.

In a study of use of auxiliary hydrocarbon fuels in a nuclear-powered aircraft three typical fuels were exposed to 10^8 r of gamma radiation from spent fuel elements. Changes in physical and chemical properties, consonant with dehydrogenation and polymerization as major reactions, were observed but without degradation of significant fuel properties (particularly thermal stability). Under these conditions a saturated kerosine should be a satisfactory fuel. Aromatics may have reduced the over-all reaction, but only as a result of their sacrificial reaction. Exposure of the same fuels to reactor radiation (including neutrons) at about 10^7 r indicated severe loss in thermal stability, though other radiation damage was barely discernible. This may be partly a dose level effect but is probably also an attribute of neutron irradiation. (auth)

5648

EFFECT OF FISSION RECOIL FRAGMENTS ON THE THERMAL CONDUCTIVITY OF GRAPHITE. L. P. Hunter (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 1969-75(1959) Dec.

The variation of the thermal conductivity of uranium-impregnated graphite is measured continuously while under neutron irradiation. The temperature is continuously monitored and results are reported which show the effects of the uranium oxide particle size as well as the effect of the neutron bombardment as separated from the fission recoil bombardment. (auth)

5649

DEFECTS IN DISLOCATIONS PRODUCED BY FOCUSING COLLISIONS IN f.c.c. LATTICES. G. Leibfried (Oak Ridge National Lab., Tenn.) J. Appl. Phys. 31, 117-21(1960) Jan.

It is assumed that a focusing collision of sufficiently high energy encountering a stacking fault area of an extended dislocation produces a Frenkel pair. This effect is thought to be important in radiation damage where primary knock-ons produce long range focusing collisions. The number of Frenkel pairs which are produced this way is calculated. Two effects are discussed in detail for Cu: (1) The enhancement of damage by enhanced production of Frenkel pairs if dislocations are present. It is shown that one can expect an appreciable enhancement of damage for heavily cold-worked material. (2) The pinning of dislocation motion. If one

assumes that each Frenkel pair produced in a dislocation acts as a primary point, the theoretical result is in qualitative agreement with the experimental data on dislocation pinning by irradiation. (auth)

5650
MECHANICAL PROPERTIES OF IRRADIATED SOLIDS. F. A. Levi (Università, Perugia, Italy). Nuovo cimento (10) 12, Suppl. No. 2, 124-296(1959). (In Italian)

A literature survey was made of 693 papers published between December 31, 1956, and January 16, 1959, on irradiation effects on the mechanical properties of solids. The effects of neutron, deuteron, and electron bombardment on various elements, alloys, and semiconductors at different energies are tabulated. The generation and annealing of imperfections in solids are discussed. (C.J.G.)

5651
ANNEALING OF ELECTRON IRRADIATED GERMANIUM. G. Airoldi, Z. Fuhrman, and E. Germagnoli (Centro Informazioni Studi Esperienze, Milan). Nuovo cimento (10) 14, 452-3(1959) Oct. 16. (In English)

Single crystals of n-type germanium with intitial resistivities of 0.01 to 1 cm were uniformly irradiated with 1.3-Mev electrons. In the fast initial recovery, the percentage of residual defects n/n_0 is linearly dependent on $t^{\frac{1}{2}}$, as predicted by Waite. The percentage of radiation-induced Frenkel pairs disappearing in this early stage ranges between 15 and 40% in the interval 190 to 270°C. Assuming the capture radius as defined by Waite to be 5×10^{-8} cm, the value of D (diffusion coefficient of defects) was determined to be $\sim 10 \exp [-1.4 \text{ ev}/kT] \text{ cm}^2 \text{ S}^{-1}$ (C.J.G.)

5652
THE IRRADIATION-INDUCED PHASE TRANSFORMATION IN ZIRCONIA SOLID SOLUTIONS. J. Adam and B. Cox (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 11, 31-3(1959) Nov.

The phase transformations revealed by x-ray diffraction studies of the effect of neutron irradiation on the structure of ZrO_2 and SrO_2 solid solutions with various additives are reported. (auth)

PHYSICS

General and Miscellaneous

5653 AD-200700
Office of the Secretary of Defense (Research and Engineering), Washington, D. C.
SHOCK AND VIBRATION BULLETIN NO. 26. PART II. [Proceedings of] the 26th Shock and Vibration Symposium, held at the U.S. Naval Training Center, San Diego, California, on May 21-22, 1958. Dec. 1958. 333p.

The unclassified papers delivered at the 26th Shock and Vibration Symposium are presented. The subjects of the papers include: missile environments, response and reliability; transportation environments and test facilities; measurement of environments; analytical studies and analysis of environmental data; and fatigue studies and miscellaneous subjects. (W.L.H.)

5654 AECU-4534
Illinois. Univ., Urbana.
DIFFUSION IN A TEMPERATURE GRADIENT. Technical Report No. 16. James S. Koehler. June 1959. 10p. Contract AT-(11-1)-182. OTS.

The methods of irreversible thermodynamics are used to obtain the vacancy concentration in the steady state along a temperature gradient. Interstitial migration by an interstitial mechanism or by the direct motion of a small atom is considered. In the case of vacancies an attempt is made to show that E_F must exceed E_M or else a physically impossible spatial defect distribution would arise for the situation where a steady state exists when a temperature gradient is maintained. The distribution of vacancies is found for this case. Similar calculations are carried out for interstitials. (W.D.M.)

5655 AECU-4596
Colorado. Univ., Boulder.
FINAL TECHNICAL REPORT [ON PHYSICS RESEARCH]. Nov. 30, 1959. 15p. Contract AT(11-1)-506. OTS.

Results are summarized on theoretical considerations of the excited states of the Ca isotopes, experimental studies of the level structure of Ca^{42} and Ca^{44}, studies of the production of circularly polarized bremsstrahlung by beta rays, the Møller scattering spectrometer, and the Møller scattering coincidence experiment. (W.D.M.)

5656 AFOSR-TN-59-167
Plasmadyne Corp., Santa Ana, Calif.
RESEARCH ON HIGH INTENSITY IONIC JETS. Final Technical Report. Gordon L. Cann and Adriano C. Ducati. Nov. 5, 1959. 37p. Contract AF49(638)-54. (P-FR109-54).

The various steps that have been completed in the development of a practical jet propulsion unit are outlined. The steps that still need to be completed before a prototype unit can be constructed are indicated. Space flight propulsion studies definitely indicate that for practically all space missions electrically driven rockets offer a substantial saving in mass over chemical rockets. Results of typical mission studies are presented and the analytical and experimental work conducted to develop the plasma jet as a means of propulsion is outlined. (W.D.M.)

5657 ARF-1150-3
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DESIGN STUDIES ON CESIUM-137 AS A SOURCE FOR HIGH LEVEL GAMMA IRRADIATORS. Quarterly Progress Report No. 1 covering the Period June 1 to August 31, 1959. Louis Voyvodic and C. A. Stone. Dec. 11, 1959. 23p. Contract AT(11-1)-779. OTS.

A study was made of radiation physics problems involved in the design of high-level cesium-137 gamma sources. The radiation properties of cesium-137 sources are reviewed and design and dosimetry problems are discussed. The economics, efficiency, and dose distribution for material undergoing process irradiation were calculated. A comparison of cesium-137 with cobalt-60 gamma sources indicated that in the case of irradiators specifically designed for high efficiency of useful energy conversion, the performance of cesium-137 source material should be at least comparable to the performance of cobalt-60 source material. (C.H.)

5658 CEA-948
France. Commissariat à l'Énergie Atomique, Paris.
REFLEXION DES NEUTRONS RAPIDES SUR LE POLYETHYLENE. (Reflection of Fast Neutrons by Polyethylene). P. Lafore, J. P. Millot, and J. Rastoin. Dec. 1958. 7p.

The reflection of fast neutrons of 0.5, 1, and 2 Mev, converging at various angles of incidence on thicknesses of 3 and 6 cm of polyethylene, has been studied by a Monte-Carlo method. To simplify the calculations tables are

given showing as a function of the emitting reactor, the flux, the dose, and the error on the dose, as well as the total albedo. (auth)

5659 CNC-19

Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.

IL RALLENTAMENTO DEI NEUTRONI IN UN MEZZO OMOGENEO INFINITO. III. RALLENTAMENTO CON CATTURA VARIABILE. (On the Slowing Down of Neutrons in an Homogeneous Infinite Medium. III. Slowing Down with Varying Capture). V. Boffi. Nov. 1959. 23p.

The study of the slowing down of neutrons is extended to include the capture process. The slowing down with varying capture and in particular the case of 1/v-capture are discussed. (auth)

5660 DEGIS-41(R)

United Kingdom Atomic Energy Authority. Development and Engineering Group. Library and Information Dept., Risley, Lancs, England.

BIBLIOGRAPHY ON PLUTONIUM FUELLING AND CYCLING. G. I. Maughan, comp. 11p. BIS.

A bibliography on the use of plutonium as a nuclear reactor fuel is presented. Included are 65 unclassified references to reports, books, and journal articles from U.K.A.E.A. Abstracts Index (1953 to date), Nuclear Science Abstracts (1953 to 58), and Engineering Index (1953 to 58). (J.R.D.)

5661 GAT-T-689

Goodyear Atomic Corp., Portsmouth, Ohio.

PRESENT AND PROPOSED METHODS FOR CALCULATING ABSORPTION AND RADIAL DIVERGENCE CORRECTIONS FOR DIFFRACTION LINE CONTOURS FROM DEBYE-SCHERRER POWDER PATTERNS. J. M. Carter and F. J. Musil. Oct. 20, 1959. 43p. Contract AT(33-2)-1. OTS.

The present and proposed methods for calculating absorption and radial divergence corrections for diffraction line contours are discussed in detail. The present method includes a combination of hand calculation, hand plotting of curves, and IBM 650 computation. The proposed method, when completed, would result in complete programming for the IBM 650 or a combination of IBM 650 and analog computer. The present method requires about 100 manhours for a complete set of contour calculations from 20 ΔI_j curves per diffraction line. The proposed method would require about 20 minutes by equivalent personnel to accomplish the same thing. It is estimated that about 50-100 computations of this type will be needed to complete our lattice parameter program in this area. (auth)

5662 GAT-T-707

Goodyear Atomic Corp., Portsmouth, Ohio.

THE DETECTION OF FREON LEAKS IN CONVERTERS BY INFRARED METHODS. D. L. Scott. Dec. 15, 1959. 17p. Contract AT(33-2)-1. OTS.

The leakage of Freon into the cascade process stream is detrimental both from the standpoint of production and economic factors. Hence, it is highly desirable to pinpoint the leak to the leaking converter as quickly as possible. The original method of locating converter Freon leaks consisted of sampling each stage of a leaking cell in the cascade and analyzing the samples using infrared spectrometers in the laboratory building. Because of the need for transporting samples from the cascade to the infrared laboratory, it was felt that this method was somewhat inefficient and inflexible. A survey was made of alternate methods which would be more flexible and which would take less time. On this basis, it was felt that a portable non-dispersive type infrared analyzer would be a satisfactory, reasonably inexpensive instrument to handle this task. Since such an instrument can be brought to the sampling blister of the leaking cell, the time consuming aspects of transporting samples from the cascade to the laboratory are eliminated. After surveying the portable infrared instruments available on the market, it was decided to purchase a Beckman Model 15A infrared analyzer and install it on a portable cart with the necessary auxiliary equipment. This instrument was purchased at an approximate cost of $2900.00 During the past year, ten leaks have been detected using the Beckman analyzer, with an average expenditure of three manhours per leak determination, as compared to an average of about sixteen manhours per leak using the original method. A saving of about 25 percent in cell down time was also achieved. (auth)

5663 GEAP-3031

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.

ADJOINT FLUX CALCULATIONS WITH MULTIGROUP FLUX CODES. John W. Weil. June 26, 1958. 15p. (R-58-APE-15).

A generalized discussion is given of the techniques which can be used with existing multigroup flux codes to obtain solutions of the adjoint flux equations. Four classes of cases are delineated which can be handled with computer programs containing no special features for adjoint solutions. Suggestions are made for inclusion in future multigroup flux codes to permit generalized solution of the adjoint problem. (auth)

5664 GEAP-3128

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.

ON THE ANALYSES OF SPECTRA MEASUREMENTS IN A POISONED THERMAL COLUMN. J. L. Russell, Jr. and G. H. Kear. Mar. 5, 1959. 8p. (R-59-APE-9).

The properties of the thermal neutron spectrum in a thermal column are investigated. It is shown that the spectrum is strongly dependent on the properties of the transfer cross section. It follows that measurement of the spectrum in a thermal column is one method of measuring properties of the transfer cross section. (auth)

5665 IDO-14384

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MANUAL OF PROCEDURES FOR EFFECTING CONTROL OF SS MATERIAL. B. S. Lewis, F. H. Tingey, and F. P. Vance. Sept. 1, 1956. Changed from OFFICIAL USE ONLY Dec. 28, 1959. 63p. Contract AT(10-1)-205. OTS.

A program of nuclear materials control is described which represents a practicable approach to an optimum combination of measurement and accounting. The program is based on the principle that surveillance of plant material balance is basically a chemical engineering function. Measurement data are under rigorous statistical scrutiny. Chemical process engineers maintain surveillance over routinely collected process control data, and by means of an effective project organization, the information so generated flows via direct lines to the attention of a small clerical staff who prepare periodic reports. The procedure has proved very economical. (C.H.)

5666 IS-14

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN PHYSICS FOR JANUARY-JUNE, 1959. Oct. 1959. 56p. Contract W-7405-eng-82. OTS.

Four-Fermion interactions with spin $\frac{1}{2}$ neutrinos are

discussed. A quicker and simpler method of deriving the Schiff approximation for analyzing measurements of high-energy electron scattering by atomic nuclei was found. Previous work on the potential of a homogeneous ellipsoid was extended to apply to any distribution in which the surfaces of constant density are a family of similar ellipsoids. The beta spectra of Pm^{141}, In^{114}, and P^{32} were examined. An improved method for irradiating samples internal to a synchrotron or betatron vacuum chamber is discussed. A search was made for nuclear gamma rays following the positron decays of several of the mirror nuclei. The internal conversion coefficient of the 149 kev E_3 transition in Cd^{111m} was measured to be 2.280 ± 0.011. Injection studies for FFAG accelerators are discussed. The specific heat and electrical resistivity of high-purity thorium were measured from 25 to 1000°C. Hall effect and electrical resistivity measurements were made on Mg_2Si single crystals from 5 to 300°K. Measurements of the Seebeck coefficients of Mg_2Si and Mg_2Ge were continued in the temperature range from 300 to 1000°K. The elastic constants of Mg_2Sn were measured in the range from 100 to 300°K. Electrical resistivity of Na_xWO_3 was measured from 25 to 600°C. Determination of precise lattice constants of the tungsten bronzes is discussed. A more thorough investigation of the Knight shift of the Na^{23} nuclear magnetic resonance in Na_xWO_3 was completed. Further work was done on measuring cohesive energies of Eu, Gd, Ho, and Er. The average cross sections for the liberation of electrons and holes from charge traps in diamond was calculated. Results from a study of surface ionization by tungsten and iridium are given. (For preceding period see ISC-1115.) (W.D.M.)

5667 KAPL-M-GPC-2

Knolls Atomic Power Lab., Schenectady, N. Y.

A VARIATIONAL PROCEDURE FOR OBTAINING SPATIALLY DEPENDENT THERMAL SPECTRA. G. P. Calame and F. D. Federighi. Dec. 22, 1959. 44p. OTS.

Knowledge of the spatially dependent thermal spectrum near an interface between different media is important for many reactor calculations. The Kantorovich variational method is utilized to solve the equation $-D_n(E)\,\nabla^2\Phi_n(E,\bar{r}) + \Sigma_{t,n}(E)\,\Phi_n(E,\bar{r}) - \int_0^{Ec}\Sigma_{s,n}(E'\rightarrow E)\,\Phi_n(E',\bar{r})dE' = S_n(E)$ where the subscript n denotes the n^{th} spatial region. A functional, J of $\Phi^+(E,\bar{r})$ and of $\Phi(E,\bar{r})$ is found such that the solutions to the equation and its adjoint make J stationary. Trial functions for Φ and Φ^+ are employed which are linear combinations of the infinite medium spectra and adjoints, respectively, of the hardest and softest regions. The constants of combination are undetermined functions of $\bar{r}$. These trial functions are inserted into J and the energy integrations performed. When the resulting expression is made stationary with respect to arbitrary variations of the adjoint constants of combination, there results in the n^{th} region a set of two coupled differential equations for the flux constants of combination. The equations are solved, yielding the energy spectrum as a function of position. The spectrum is used to obtain activation rates, and the rates are compared to experiments. The agreement is excellent. The method, that of overlapping groups, appears to be a promising one for the solution of the thermal space energy problem in reactor calculations. (auth)

5668 KAPL-M-WBW-9

Knolls Atomic Power Lab., Schenectady, N. Y.

WATER GAP PEAKING IN THE PRESENCE OF HYDROGEN DENSITY GRADIENTS. W. B. Wright and S. F. Weinstein. Dec. 16, 1959. 16p. Contract W-31-109-Eng-52. OTS.

For reactors in which boiling can occur, power peaking may be complicated by local boiling near water channels. The resulting hydrogen density distribution, power, and flow are coupled in a complicated way dependent upon the geometry, pressure, etc. A perturbation calculation of the peaking in the presence of hydrogen gradients is reported. The method is applied to a series of PPA experiments in which gaps were immersed in know hydrogen distributions and the calculations and experimental results are compared. (W.D.M.)

5669 LA-2260

Los Alamos Scientific Lab., N. Mex.

NUMERICAL SOLUTION OF TRANSIENT AND STEADY-STATE NEUTRON TRANSPORT PROBLEMS. Bengt Carlson. May 16, 1959. 30p. Contract W-7405-eng-36. OTS.

A general numerical procedure, called the discrete S_n method, for solving the neutron transport equation is described. The main topics relate to the derivation of suitable difference equations, and to the problem of solving these, while maintaining generality, accuracy, and reasonable computing speed. A few comparisons with other methods are made. (auth)

5670 LA-2335

Johns Hopkins Univ., Baltimore.

NEW DATA ON THE EMISSION SPECTRUM OF AIR. Donald Frederick Heath. Jan. 1959. 76p. For Los Alamos Scientific Lab. Contract W-7405-eng-36. OTS.

The relative intensities of the spectra from mildly excited discharges in N_2, air, NO, O_2, and mixtures of these gases were studied under high resolution as a function of pressure (0.01 to 760 mm). Most of the work was concerned with the disappearance of the first positive group of N_2 in high pressure air discharges. The intensity distribution of the bands of the second positive group of N_2 (the lower state is the upper state of the first positive group) was found to be identical over a pressure range of at least 10^5 in air and N_2 discharges of the same pressure. For the same intensity of the second positive group in both discharges, information has been given on the ratio of the intensity of the bands of the first positive group in a pure N_2 discharge to a discharge in air or a mixture of N_2 and O_2 or NO of the same total pressure as a function of the upper level of these bands. The results showed that the bands were weakened most from v = 5, 6, and 7 of $B^3\Pi_g$ of N_2 and have been reduced in intensity by more than a factor of 20 in an air discharge at atmospheric pressure when compared to a corresponding discharge in pure N_2 and for the same intensity of the second positive group. It is postulated that the disappearance of the first positive group of N_2 in high pressure air discharges is due to a collision between $N_2(B^3\Pi_g)$ and $NO(X^2\Pi)$ which induces a radiationless transition to $N_2(X^1\Sigma_g^+)$ with a resonance transfer of the energy to $NO(X^2\Pi)$. Information was also given on the intensity behavior with pressure of the other spectral features of these discharges. (auth)

5671 NAA-SR-3788

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

NEUTRON MODERATION BY ACOUSTIC MODES OF METAL HYDRIDES. E. U. Vaughan. Dec. 1, 1959. 25p. Contract AT-11-1-GEN-8. OTS.

The excitation by nuclear collisions of the acoustic modes of a metal hydride crystal was investigated, using a model of the crystal based on experiments on ZrH_2, but slightly more general. It is found that these modes contribute little to neutron moderation in ZrH_2. In the course

of the discussion, a generalized form of the Wilkins equation, which determines the spectrum of neutrons thermalizing in a heavy moderator, is developed, applicable when the scattering cross section varies with energy. (auth)

5672 NAA-SR-3867

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DIFFERENTIAL PRESSURE SAFETY DEVICE. R. Holland. Jan. 15, 1959. 34p. Contract AT-11-1-GEN-8. OTS.

A safety device was developed for power reactors that utilizes the differential pressure between two chambers as a triggering mechanism. Two contained volumes of gas are separated by a rupturable diaphragm. One volume is heated by a fission source. Although the pressure in both chambers is a function of ambient temperature, the differential pressure is a function of the output of the fission heat source only. Thus, the triggering mechanism is independent of ambient temperature, but directly dependent on neutron flux. Tests were conducted to demonstrate the feasibility of rupturing a diaphragm with the differential pressure between two chambers. An electrical heater in one chamber was powered by a generator, which provided a voltage exponential in time, to simulate the heat generated by a fission heater during reactor excursions. Diaphragms with up to 7-atm burst pressures were ruptured on simulated reactor transients. The device time response was investigated by measuring the device thermal relaxation time for several pressurizing gases. Thermal relaxation times were approximately 1½, 2½, and 4 sec for helium, argon, and carbon dioxide, respectively. Poison dispersal studies were conducted to measure poison distribution and transfer time. In a typical case for a powdered boron charge of 10.5 grams dispersed into a 3-in. diam. tube, the boron reached the end of a 3-ft tube 13 millisec after trip. A disadvantage of the basic differential pressure device is an inadequate supply of energy for an effective chamber volume. Two modifications of the basic design have evolved. One provides the propulsion energy from the exothermic reaction of boron and fluorine. The other utilizes the sum of the pressures of the two chambers rather than the difference to propel the poison. (auth)

5673 NAA-SR-Memo-4246

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

NEUTRON FLUX DISTRIBUTIONS IN A 19 ROD FUEL ELEMENT. O. R. Hillig. Aug. 11, 1959. 13p. OTS.

Results of measurements of thermal and epithermal flux distributions in and near a single 19-rod element made up of ¾-in.-diam. 2.78 wt.% enriched U fuel are presented. The element was inserted in a buffer lattice of 0.9124 wt.% enriched U single rod elements of 1-in. diam. in a graphite moderator. The lattice consisted of 25 elements arranged in a 5 by 5 square array at a 9½-in. spacing. (W.L.H.)

5674 NP-8125

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

CRYSTAL PHYSICS. Annual Summary Report No. 1 covering period from June 15, 1958 to November 15, 1959. Technical Report No. 144. Nov. 1959. 38p. Contract Nonr-1841(50).

Investigations of crystal growth processes, preparation of single crystals of specified properties, and crystal defects were conducted. Chemical precipitation from solution, recrystallization from solution, melt filtration, evaporation, scavenging, recrystallization from the melt, and ozone refining were among the methods used for purification. For the purpose of growing mixed crystals of Al_2O_3 and Cr_2O_3 the mixed crystals of desired composition were prepared from corresponding alums and converted to oxides by calcination. Single crystals of CsCl were grown from solution, NH_4 contamination was detected, and its elimination is being studied. The influence of crystal orientation on growth and perfection was studied on KBr crystals grown in the [1 0 0], [1 1 0], and [1 1 1] directions. There is evidence that the concentration of vacancies depends on the growth direction of the crystals. Mixed crystals of CaF_2 with YF_3, for the study of color centers, were grown from the melt. Mixed crystals of Al_2O_3 and Cr_2O_3 with various compositions were grown by the flame-fusion methods. Thermal etching in vacuum was used to study imperfections and lattice decomposition in alkali halides. Color centers are being studied in connection with crystal defects and electron and hole traps in solids. (J.R.D.)

5675 NP-8190

[Iowa State Univ. of Science and Technology, Ames].

TEXT OF PAPER C-5: FAST MOLECULAR NITROGEN BEAM GIVEN AT THE 12TH ANNUAL GASEOUS ELECTRONICS CONFERENCE OCTOBER 14, 1959, AT NATIONAL BUREAU OF STANDARDS. Nyle G. Utterback and Glenn H. Miller. 13p.

Nearly all the work which has been done with molecular beams has included the energy regions below 1 ev and above 100 ev. An attempt to span this neglected gap is being made in order to understand phenomena occurring on the surface and in the gas surrounding a missile. The problem of constructing a source of molecules in this energy region is considered and some results relative to feasibility and basic physics are given. (W.D.M.)

5676 NP-8215

Convair Scientific Research Lab., San Diego, Calif.

PRODUCTION OF FREE RADICALS IN THE SOLID STATE BY ION BOMBARDMENT. Research Note No. 16. H. A. Papazian. Apr. 1958. 11p.

A relatively simple way to produce free radicals in the condensed phase of gases and vapors by ion bombardment is described. The method utilizes the Tesla coil discharge which produces bombarding particles of both negative and positive charge in the vacuum system. (auth)

5677 NP-8230

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

SPACE CHARGE LIMITED CURRENT FLOW FROM A PLANE, PLASMA "CATHODE." Burton D. Fried and Lee O. Heflinger. Oct. 26, 1959. 13p. Contract AF04(647)-309. (TR-59-0000-00870).

An equation analogous to Langmuir's is derived for the case where the potential, $k T_{e/e}$, is large compared to the potential difference between anode and cathode. A simple case—plane, parallel geometry—is considered for which an exact solution can be found. Realizable configurations will always be more complicated than this, but the present results should have at least an order of magnitude validity in such cases. (W.D.M.)

5678 NYO-2673

TRG, Inc., Syosset, N. Y.

HETEROGENEOUS REACTOR CALCULATION METHODS. Quarterly Progress Report No. 1 [for] April 1–June 30, 1959. Carl N. Klahr. 45p. Contract AT(30-1)-2375. (TRG-129-QTR-1). OTS.

The outstanding problems and work areas necessary for proper application of heterogeneous reactor calculation

methods are listed. The self-consistent equations are formulated for a thermal reactor with significant non-thermal fissions. Equations for calculating the effects of resonances on the slowing down kernels are given. The moderator absorption is expressed in terms of the rod absorptions. This relation is used to calculate the thermal utilization and resonance escape probability for the reactor. The resulting formulas can be used to obtain these two quantities for lattices with different types of rods and thus provide the necessary input for approximate homogeneous calculation of these systems. Various methods are considered for determining values of some of the rod parameters which are needed in a heterogeneous calculation. (W.D.M.)

5679 ORNL-2861
Oak Ridge National Lab., Tenn.
THE SCATTERING AND POLARIZATION OF SPIN ONE PARTICLE. G. R. Satchler. Jan. 20, 1960. 42p. Contract W-7405-eng-26. OTS.

The optical models which may be used to describe the scattering and the possible forms of spin-orbit coupling are discussed. The scattering amplitudes are defined and described, including the effects of an isolated resonance, and used to give expressions for the differential cross section and polarization. The latter results are extended to include the change of polarization induced on scattering a polarized beam. Double scattering and the change in polarization produced by deflection in a magnetic field are described. A detailed discussion of possible tensor spin-orbit couplings is given. (W.D.M.)

5680 RM-1825-AEC
RAND Corp., Santa Monica, Calif.
THE BLAST WAVE IN AIR RESULTING FROM A HIGH TEMPERATURE, HIGH PRESSURE SPHERE OF AIR. H. L. Brode. Dec. 3, 1956. 69p. Contract AT(29-1)-1477. OTS.

Results are presented of a calculation of the blast wave resulting from the explosion of a sphere of air initially at rest and at standard sea-level density but at 20,000 atmospheres pressure. Results are presented in graphical form, showing the variations of overpressure, density, particle velocity, temperature, and dynamic pressure as functions of space and time. Shock values of these parameters, total impulses, positive durations, and shock arrival times are also illustrated. Comparison is made with other calculations and with observations. (auth)

5681 RM-2447-AEC
RAND Corp., Santa Monica, Calif.
THE EMISSIVE POWER OF IONIZED HYDROGEN GAS. Joseph M. Green. Aug. 24, 1959. 23p. Contract AT(29-1)-1477. OTS.

The emissive power per atom of hydrogen is computed for spontaneous emission into the continuous spectrum lying between the L and M edges. The results are quoted for temperatures between 3 and 30 ev and densities between 10^{15} and 10^{17} atoms per cubic centimeter. It is shown that under the stated thermodynamic conditions the complicating effect of free electron screening and bound electron screening may be neglected. Consequently the results are obtained from forms suitable for hand computation. (auth)

5682 SCTM-341-59(51)
Sandia Corp., Albuquerque, N. Mex.
NOTE ON LINEAR ELECTRO-OPTIC EFFECTS AND A POSSIBLE APPLICATION TO SHOCK WAVE DIAGNOSTICS. H. G. Baerwald. Nov. 2, 1959. 14p. Contract [AT-(29-1)-789]. OTS.

This memorandum, which does not aim at completeness, is a tutorial exposé principally on the linear electro-optic effect (Pockels effect). It presents a basic description, comprising tensorial character and connection with related effects—birefringence, Kerr effect, rotation; utilization for, and quantitative relations involved in, light modulation, in particular with wide linear range; conditions imposed by crystallographic symmetry, with a deductive survey of all physically possible arrangements for quasi-linear electro-optic light control; a survey of standard notations, numerical values, and a brief description of special arrangements. A possible application to a sophisticated scheme of shock diagnostics is discussed. (auth)

5683 WAPD-MRJ-8
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
REACTOR PHYSICS AND MATHEMATICS TECHNICAL PROGRESS REPORT FOR PERIOD SEPTEMBER 1 TO DECEMBER 1, 1959. 76p. Contract AT-11-1-GEN-14. OTS.

The relative fission rates of Pu^{239} and Pu^{241} were determined in a water–uranium reactor spectrum. The relative resonance fission integrals of U^{235}, Pu^{239}, and Ru^{241} were measured in a 1/E flux spectrum. The diffusion length of thermal neutrons was measured in H_2O poisoned with various concentrations of B. Thermal neutron diffusion lengths, decay constants, and buckling dependence of the extrapolation distance were calculated for water, using a thermal multigroup method. Intercomparison of a P-3 and a higher order transport approximation indicated that the P-3 approximation yields an adequate representation of deep penetration in a hydrogeneous media. An improved difference scheme, applicable to the one-dimensional diffusion theory problem was developed which compares favorably with the conventional scheme. Work was continued on the development of a model for the simulation of reactor transient behavior including the effects of boiling. Analytical methods for the study of the stability of the reactivity feedback loop of a boiling core were developed and successfully applied to an observed instability of an operating core. Work was continued on methods of modal analysis for the study of flux tilt transients and spatial stability. Application to cores of simple geometry showed a pronounced delay in the tilt because of delayed neutron effects. Inclusion of xenon feedback showed the dependence of spatial stability on power density, tilt sensitivity, and the temperature coefficient of reactivity. Additional experimental verification was obtained of a new method of predicting the thermal neutron flux distribution in a laminated metal-hydrogeneous reactor shield. Gamma dose build-up factors in metal-water laminations were calculated by a Monte Carlo method. Mathematics and digital computation work are summarized. (For preceding period see WAPD-MRJ-7.) (W.D.M.)

5684 WT-1113
Chemical Warfare Labs., Army Chemical Center, Md.
DUST DENSITY VERSUS TIME AND DISTANCE IN THE SHOCK WAVE. M. G. Gordon, J. F. Stoudt, and A. B. Francis. June 21, 1957. Decl. Sept. 19, 1959. 52p. Project 1.13 [of] OPERATION TEAPOT. OTS.

During Operation Teapot the shock wave was sampled for gross air density and dust loading. Measurements were made of the character of the dust present at 3-foot and 10-foot levels above the desert and asphalt surfaces during the passage of the shock wave produced by the MET shot. Continuous beta densitometer measurements were made of total air density as a function of time, and measurements

were made of dust concentration and particle size distribution in the shock wave. Data are tabulated. The data obtained on total air density within the precursor or shock wave will supplement available data in determining the role of dust in damaging targets and understanding the precursor shock wave development, decay, and characteristics. (C.H.)

5685 AEC-tr-3943

THE DETERMINATION OF SMALL SURFACE AREAS BY KRYPTON ADSORPTION. R. A. W. Haul. Translated by M. J. Steindler (Argonne National Lab.) from Angew. Chem. 68, 238(1956). 24p. JCL.

In many branches of chemical research and technology the determination of small surface areas, perhaps below one square meter per gram, plays an important role. Low temperature adsorption of krypton, is in these cases, superior to the usual nitrogen adsorption method. Some of the unique features of the method are described and the choice of saturation pressure and surface area requirements to be used in krypton adsorption is discussed. (auth)

5686 AFCRC-TR-59-162

THEORY OF ELECTRIC FLUCTUATIONS AND THERMAL RADIATION. S. M. Rytov. Translated by Herman Erkku (Air Force Cambridge Research Center) from a publication by the Academy of Sciences Press, Moscow, 1953. 278p. (AD-226765). OTS.

The theory of electrical fluctuations based on the application of statistics to macroscopic electrodynamics is presented. The general electrodynamic approach permits the study of problems in which neither the condition of being quasi-stationary nor the condition of applicability of geometrical optics are required. Basic attention is given to the indicated formulation of the problem and to the development of the theory derived from it. The monograph is directed to research workers and graduate students interested in questions of electrical fluctuations and thermal radiation. (W.D.M.)

5687 CEA-tr-R-520

MÉTHODE D'INDUCTION NUCLÉAIRE LIBRE DANS DES CHAMPS MAGNÉTIQUES FAIBLES, APPLIQUÉE À CERTAINS PROBLÈMES DE RADIOSPECTROSCOPIE À POUVOIR DE RÉSOLUTION ÉLEVÉ. (Free Nuclear Induction Method in Weak Magnetic Fields Applied to Certain Problems of Radiospectroscopy at High Resolution). A. A. Morozov (Morosov), A. V. Mel'nikov, and F. I. Skripov (Ckripov). Translated into French by J. Melnick from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, 1141-4(1958). 9p.

Two examples of the application of the free induction method in radiospectroscopy are given. The first is the study of the fine structure of nuclear resonance signals stimulated by indirect interactions of non-equivalent nuclei in the molecule. The second study was devoted to a measurement of the resonance frequencies in the terrestrial magnetic field. (T.R.H.)

5688 CEA-tr-R-716

PIÈGE À VIDE POUSSÉ AVEC UN REFROIDISSEMENT THERMOÉLECTRIQUE. (Vacuum Pressure Trap with Thermoelectric Cooling). E. A. Kolenko. Translated into French by B. de Trezvinsky from Pribory i Tekh. Ekspt., No. 3, 112(1957). 4p.

A trap for oil vapor pumps is described which utilizes a thermoelectric battery to cool the condensation surface to −30°C. The surface configuration is such that the oil vapor molecules are reflected three times before entering the evacuated volume. The battery is supplied by a continuous source of 10 to 12 a at 6 to 8 v and consumes 8 to 10 watts. (T.R.H.)

5689 CEA-tr-R-718

MESURE DES PRESSIONS DE 0,1 À 5 MM Hg PAR UN MANOMÈTRE À COUPLE THERMOELECTRIQUE. (Measurement of Pressures from 0.1 to 5 mm Hg by a Manometer with a Thermoelectric Couple). A. M. Grigor'ev (Grigoriev), L. P. Khavkin (Khavin), and N. V. Tsybina. Translated into French by B. de Trezvinsky from Pribory i Tekh. Ekspt., No. 3, 97-9(1958). 10p.

A method is described for measuring pressure from 0.01 to 5 mm Hg by a manometer with an LT-2 type thermoelectric couple. A procedure for identifying the calibration characteristics of the manometer in constant temperature regions is given. The means for using BT-2 manometers with LT-2 manometers were determined. (T.R.H.)

5690 SCL-T-288

APPLICATION OF THE ELLIPTICAL FUNCTIONS TO PROBLEMS OF ELECTROSTATICS. (Excerpt). F. Oberhettinger and W. Magnus. Translated by Marcel I. Weinreich (Sandia Corp.) from p.50-66 (Chap. III, Vol. LV) of "Anwendung der Elliptischen Funktionen in Physik und Technik." 1949. 20p. JCL.

Two-dimensional electrostatic fields are determined with the help of conjugate functions. Various limiting cases and examples are given. An outer conductor of circular cross section with a plane band running through the axis as an inner conductor and a plane band in an outer conductor of rectangular cross section are discussed. (W.D.M.)

5691 TIL/T-4711

METHODS OF SOLUTION OF THE BASIC EQUATIONS IN THE THEORY OF ELASTICITY. (Ansätze zur Lösung der Grundgleichungen der Elastizitätstheorie). K. Marguerre. Translated from Z. angew. Math. u. Mech. 35, 242-63 (1955). 32p.

In recent days, many special problems of two and three dimensional theory of elasticity have been solved. The methods of attack, apparently varying from author to author, can be shown to be closely related to one another: basically all the different solutions turn out to be built up by a set of potentials. The procedures of about 50 papers, together with an interesting new one, are discussed in such a way that their inter-relations become clear. Elasticity problems of two (plane, axial-symmetry) and three dimensions, as well as problems of the torsion type are dealt with. An appendix gives the necessary rules of vector and tensor calculus. (auth)

5692

CERTAIN MATTERS IN RELATION TO THE RESTRICTED THEORY OF RELATIVITY, WITH SPECIAL REFERENCE TO THE CLOCK PARADOX AND THE PARADOX OF THE IDENTICAL TWINS. I. FUNDAMENTALS. W. F. G. Swann (Franklin Inst., Swarthmore, Penna.). Am. J. Phys. 28, 55-64(1960) Jan.

The significance of the meaning of space-time coordinates as attached to "events" in the Lorentzian transformation is discussed. Restricted relativity involves two distinct parts: A—the invariance of the forms of the laws under the transformation: B—the hypothesis that similar experiments performed in relatively moving frames S and S' give identical results. The test of A is a matter of pen and paper. B involves the hypothesis that the instruments are such that the actual measurements of space-time coordinates of events shall be related, for the two systems, by the transformation. Only by the postulation

of a theory such as the quantum theory, but one relativistically invariant in sense A, can one understand the relationship between the instruments, whether the said instruments be constructed by independent observers in S and S′ from the material around them, or whether the observer in S′ acquires his instruments from S by setting them in motion. The second method of acquiring the instruments will not, in all cases, yield measurements related by the transformation. Thus, if one starts with a system of isolated clocks which have been synchronized in S according to Einstein's principle, and if they are transferred to S′, their "rates" (in a suitably defined manner) may be expected to alter in accordance with the transformation. However, it will remain for the observer in S′ to synchronize the clocks in that new frame, having adjusted the time origin of one of them. (auth)

5693

THE SPECIFIC HEAT C_v OF LIQUID HELIUM NEAR THE λ-CURVE AT VARIOUS DENSITIES. O. V. Lounasmaa and E. Kojo (Univ. of Turku, Finland). Ann. Acad. Sci. Fennicae Ser. A VI, No. 36, 1-26(1959).

The specific heat C_v of liquid helium was measured from 1.5 to 2.8°K at various densities between and on the liquid-vapor and liquid-solid equilibrium lines. The results show quite clearly that the height of the λ-peak diminishes when density is increased, although the peak is still very pronounced along the liquid-solid equilibrium line. Smoothed values of C_v as a function of density and temperature are presented in tabular form and an entropy diagram was calculated. The estimated accuracy of the C_v-measurements is 2% below and 1% above the λ-point. The λ-curve of liquid helium was determined. (auth)

5694

NEW IONOGRAPHIC EMULSIONS WITH POLYVINYL ALCOHOL. Etsuo Fujii, Hideko Fujii, Joseph Demers, and Pierre Demers (Univ. of Montreal). Can. J. Phys. 37, 1465-73(1959) Dec. (In French)

The preparation and properties of 2 ionographic emulsions with polyvinyl alcohol (PVA) base are described. These emulsions show, in their thickness, α and proton tracks (and even some slow electrons) containing 84% AgBr. The emulsions contain no N_2 or gelatin. It is hoped that interesting mechanical properties will result in the use of PVA as a support. A procedure is described for strongly directional detection based on the use of ionographic emulsions. (tr-auth)

5695

THE EFFECT OF DEVELOPMENT ON TRACK STRUCTURE AND ON FOGGING IN FINE-GRAIN EMULSIONS. I. Ahmad and J. Demers (Univ. of Montreal). Can. J. Phys. 37, 1548-52(1959) Dec. (In French)

Fine-grain (formula 19) emulsion plates containing a little NaCl (formula 21) were exposed to 7-Mev α particles from Th and 14-Mev neutrons and developed in chlorohydroquinone. The developer formula contained 45g chlorohydroquinone, 30g Na_2SO_3, 32.5g KOH, 8g KBr, in sufficient water to make 1 liter. Development times (at 0°C) from 1 to 180 minutes were obtained by progressively submerging more and more of the plates. It was found that exposed grains are developed immediately and their diameter increases faster than unexposed grains which are developable by an energetic development. If one develops for a long time to reveal the minimum tracks, the grain diameter and fogging increase rapidly. The low-energy tracks will thus be completely saturated. The best visibility is obtained with average development. After a certain development time, when the tracks are clearly visible, the change in darkening of the grains is much faster than that of grain diameter so that the grain opacity increases without a visually apparent diameter increase. (T.R.H.)

5696

PRELIMINARY RESULTS ON A MONOCHROMATIC SOURCE OF PHOTONS PRODUCED BY POSITRON ANNIHILATION IN FLIGHT. Jacques Miller, Claude Schuhl, Gabriel Tames, and Christophe Tzara. Compt. rend. 249, 2543-5(1959) Dec. 9. (In French)

An experiment is described in which photon production by relativistic positron annihilation in flight was studied. The positrons were obtained from an electron beam from a linear accelerator. The preliminary results show that it is possible to obtain a practical photon source of narrow spectrum and variable energy. (tr-auth)

5697

THE DEPENDENCE OF THE DECAY OF LUMINESCENCE ON THE SURFACE CONCENTRATION OF THE SAMPLE. Ivan Soudek (Research Inst. of Vacuum Electrotechnics, Prague). Czechoslov. J. Phys. 8, 332-5(1958). (In Russian)

The decay of luminescence of a number of zinc-cadmium sulfides after ultraviolet excitation was measured by the mechanical persistometer. Measurement was carried out with a Czechoslovak photomultiplier 20PA250 sensitive to red and infrared radiation and protected by a red filter against the exciting radiation. Luminescent powders were sprayed onto a layer of nitrocellulose lacquer on a glass plate. The measurement was carried out on a phosphor containing 49% ZnS, 51% CdS, 10^{-4} Ag as an activator and of the order of 10^{-6} Cu as an impurity. Films of varying thickness were prepared. The surface concentration of the phosphor was determined by weighing the sample, washed from the glass. The average thickness in μ was calculated from the density of the phosphor, set at 4.46. The most frequent magnitude of the crystals was 14 μ. There is a slight difference between the initial intensities of the thicker films and only a thinner distribution of the crystals causes a more marked decrease. The time dependence of the logarithm of the intensity of decay was plotted. The relative (and to a certain extent also the absolute) difference between the values of the various curves grows with time; this comprises the difference between our curves and the measurements carried out for various exciting intensities. The greatest differences correspond to films only differing in the distribution of the isolated crystals. Qualitatively the same dependences were observed on zinc-cadmium sulfides activated by copper. The results of our measurements can be interpreted as follows: a certain interaction between the crystals supports the intensity of decay and this interaction decreases with increasing distance between the crystals. This interaction can be either optical or electronic; the fact that the distance between the crystals in continuous films is of the same order as the mean free path of the electron in air speaks for electronic interaction. (auth)

5698

ELECTRON OPTICAL PARAMETERS OF THE FIELD 1/r AND ITS APPLICATIONS IN NUCLEAR SPECTROSCOPY. Ivan Řezanka (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 355-65(1958). (In English)

Electron optical parameters are calculated for an axially symmetrical magnetic field which in the central plane decreases inversely proportionally to the distance from the axis. The equipotential surfaces of this field are coaxial cones with a common vertex. The influence of the disper-

sion on the vertical focusing is estimated. The results obtained are used in proposing sector and prismatic beta spectrometers. (auth)

5699

THE NATURE OF THE MAGNETO-MECHANICAL PHENOMENON IN CHANGING MAGNETIC FIELDS. A. Cisman, B. Rothenstein, and J. Hrianca (Institutul Politehnic, Timisoara, Romania). Czechoslov. J. Phys. 8, 374-5(1958). (In German)

Experiments are described which further investigate the hypothesis of Néel and Kittel that below a certain critical thickness of ferromagnetic layers which are formed out of a single domain region no Bloch walls are formed. The inner friction was measured of a thin Ni coating on a brass wire. (T.R.H.)

5700

MEASUREMENT OF SOME NEUTRON SPECTRA BY THE NUCLEAR EMULSION METHOD. L. Drška, I. Chudáček, and F. Štěrba (Charles Univ., Prague). Czechoslov. J. Phys. 8, 648-57(1958). (In Russian)

A neutron spectrum of a Ra-Be source was measured and investigated and a satisfactory interpretation of the spectrum shape was given. The second part includes a study on the Li(d,n) reaction on a thick target. Both the spectra were measured by using the nuclear emulsion method. (auth)

5701

THE EFFECT OF CADMIUM IONS ON THE PROPERTIES OF NUCLEAR EMULSIONS. Josef Kubal, Jaroslav Beneš, and Zbyněk Hrkal (Czechoslovak Academy of Sciences, Prague and Charles Univ., Prague). Czechoslov. J. Phys. 8, 658-64(1958). (In Russian)

A study was made of the effect of Cd (in limits from 0 to 5 molar percent) on the sensitivity and granulometric properties of nuclear emulsions. The three-solution method was used to prepare the emulsions. Two series of emulsions were studied. The first contained no admixtures having a sensitizing effect, while the second was sensitized. The prepared sensitive films were radiated with a Po deposit, sensitometrically tested for visible light in a Soviet sensitometer FSR 4 and their relative sensitivity to electrons determined by means of a radioactive wedge with the isotope C^{14}. In the sensitometric tests Soviet sensitometric developer was used for elaborating the aerophotographic material. The sensitive materials for recording the individual tracks were developed in an amidol developer with an admixture of citric acid (temperature developing cycle). The effect of cadmium ions on the granulometric properties and the sensitivity of emulsions can be studied qualitatively on the tracks of alpha polonium. The homogeneity and fine grain of the emulsion can be judged indirectly according to the contrast coefficient. In practice two molar percents of cadmium bromide suffice for the full use of the effects of the Cd^{2+} ions to attain a fine-grain emulsion with equal sizes of the grains. It follows from the experimental results that in order to obtain an isodispersion emulsion one must use at least 1 molar % from the applied amount of bromide ions in the form of cadmium bromide. Cadmium ions (in a concentration of 0.7 to 5.0 mol. %) cause sensitization of the emulsion for visible light, alpha particles and for electrons. 2-p-di-methyl-amino-styryl-benzthiazol was suggested as an effective chemical sensitizer of emulsions for ionizing radiation. With the prepared nuclear emulsions sensitivity was attained for recording the individual electron tracks (for electrons C^{14} and electrons from the disintegration family of Th). (auth)

5702

ON THE ELECTROLUMINESCENCE OF POWDERED ZINC SULPHIDE LAYERS. V. V. Antonov-Romanovskii (Antonov-Romanovskij) (Inst. of Physics, Academy of Science, Moscow). Czechoslov. J. Phys. 9, 146-60(1959). (In English)

The experimental study of the dependence of the electroluminescence brightness on the voltage confirms the correctness of the mechanism of electroluminescence, based on impact ionization in parts of the crystal where the electric field is concentrated. A study of the photoluminescent and electroluminescent spectra of phosphors containing two activators (copper and rare earth elements) permits the determination of the magnitude of the volume of the crystal in which electroluminescence occurs. A study of the influence of the stored light sum on the brightness of electroluminescence and a study of the rate of growth of the "variable" and "constant" components of electroluminescence point to the fact that the excitation is transferred from the region of field concentration to the whole volume of the crystal. (auth)

5703

ON THE PHOTO-ELECTROLUMINESCENCE OF ZnS—Cu. K. Pšítek (Inst. of Physics, Czechoslovak Academy of Science, Prague). Czechoslov. J. Phys. 9, 161-7(1959). (In English)

The influence of weak ultraviolet irradiation on the brightness waves of electroluminescence is investigated for two types of ZnS(Cu) phosphors. The effects observed (increase in brightness in the primary peak and its phase shift and the disappearance of the secondary peak) are explained on the basis of present-day conceptions on electroluminescence. (auth)

5704

THE ABSORPTION SPECTRUM OF KCl(Ca), COLORED WITH X AND GAMMA RADIATION. Pavla Coufová (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 168-71(1959). (In Russian)

A description is given of the splitting up of the F band (maximum around 0.55 μ) into bands with maxima at 0.54 μ and 0.56 μ, which are observed on coloring with gamma radiation, a small amount of x rays or after decoloring the sample by light of 0.54 μ. With repeated coloring and annealing there occurs an irreversible transition $F \rightarrow Z_2$ up to a certain value k_m of the F band. The magnitude of this coefficient depends on the coloring radiation and the total dose absorbed and not on the dose intensity. (auth)

5705

THE VAPOR JETS OF ELECTRODE MATERIAL OF A SHORT-TIME HIGH-INTENSITY ELECTRIC DISCHARGE. Vladimír Hermoch (Inst. of Mechanical Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 221-8(1959). (In Russian)

The velocity of vapors from electrodes and the values of the electric gradient of the channel were measured. An explanation is given of the dependence of the discharge rate of the vapors on the electrode material, and the thermal origin of the jets is confirmed. The validity of the results is shown for the case of a different experimental arrangement, or the formation of other types of discharges on electrodes. (auth)

5706

SOME OF THE LUMINESCENT PROPERTIES OF AgBr WITH AN ADMIXTURE OF Ag_2S. Jaroslav Frána and

František Janáček (Charles Univ., Prague). Czechoslov. J. Phys. 9, 256-7(1959). (In English)

The spectral distribution and luminescence quenching time of normal and deformed samples at low temperatures were studied on plates of AgBr plus 0.02 mole % Ag_2S. At a temperature of −180°C the luminescence spectral distribution had maxima at 6450, 6100, and 5350 A. Deformation of the plates caused a decrease of the luminescent intensity. The cause of the intensity during quenching is expressed as a hyperbolic decrease of the type $I = I_0 \{1 - [1/1 + (at)^{\alpha}]\}$, where $\alpha = 0.93$ and $a = 10^3$ for $t < 2 \times 10^{-3}$ sec and $\alpha = 0.46$ and $a = 0.6 \times 10^3$ for $t < 2 \times 10^{-3}$ sec. The decrease was more rapid in the red part of the spectrum. Illumination of the plate before the experiment resulted in a large decrease in the integral intensity of luminescence and the vanishing of the green band. (J.S.R.)

5707

THE INFLUENCE OF FRINGING ON BETATRON OSCILLATIONS IN AN ACCELERATOR WITH A SECTIONED MAGNET II. Jiří Teichman (Research Inst. of Vacuum Electronics, Prague). Czechoslov. J. Phys. 9, 388-94 (1959). (In Russian)

The influence of stray fields at the edges of pole pieces on the deformation of equilibrium trajectory and betatron oscillations is studied. A new definition of the effective length of segments for the approximative solution is given. (auth)

5708

A CONTRIBUTION TO THE SEMI-FOCUSING METHOD WITH A FLAT POLYCRYSTALLINE SAMPLE. Marie Simerska and Vladimir Synecek (Inst. of Technical Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 395-8(1959). (In English)

Conditions are derived for the approximate focusing of diffraction lines in the chosen, relatively wide angular region, using the semi-focusing method with a flat sample, if a bent crystal monochromator is employed. The form of the absorption factor for a flat polycrystalline sample is derived for the case of uniform oscillation of the sample in the angular region $\pm\epsilon$ around the axis of the camera. (auth)

5709

TEMPERATURE DEPENDENCE OF SECONDARY PEAK OF ELECTROLUMINESCENCE OF ZnS(Cu). Karel Pátek (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 460-7(1959). (In English)

The temperature and frequency dependences of the secondary peak of the brightness wave of electroluminescence were studied. The dependences found show a direct connection with the number and depth of the traps. The influence of a continuously increasing temperature on the secondary peak of electroluminescence of a sample, which has been irradiated beforehand, is found, and a description is given of a new method of determining trap depths and their number. (auth)

5710

COURSE OF ELECTROLUMINESCENCE OF ZnS(Cu, Mn). Světlana Damašková (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 529(1959). (In English)

The electroluminescence of ZnS(Cu, Mn) differs qualitatively from that of ZnS(Cu). The course of the luminescence brightness is a result of two different processes. In the first process, the brightness gradually increases when the electric field is switched on, slowly decreases during the pulse, and rapidly decreases when the electric field is switched off. In the second case, the brightness has a peak at the moment the field is switched on, rapidly decreases during the pulse, and has a secondary peak at the moment the field is switched off. The mechanism of the phenomena is discussed. (J.S.R.)

5711

RESULTS OF LOW-TEMPERATURE STUDIES. XXIX. THE ABNORMALLY LARGE VAPOR PRESSURE DIFFERENCE BETWEEN $N^{14}O^{16}$ AND $N^{15}O^{16}$. Klaus Clusius, Kuno Schleich, and Max Vecchi (Universität, Zurich). Helv. Chim. Acta 42, 2654-66(1959). (In German)

Double-labeled NO was prepared and vapor pressure measurements were made between the melting and boiling points and compared with normal nitrogen oxides. A variation of 0.6 to 8% from normal was found. A simple extrapolation of these new values for $N^{15}O^{16}$ and earlier measurements for $N^{15}O$ and NO^{16} produced relationships which do not account for the vapor pressure difference. Triple-point pressure, melting-point and boiling-point differences, and heat of vaporization differences are given for $N^{14}O^{16}$, $N^{15}O^{16}$, $N^{14}O^{18}$, and $N^{15}O^{18}$. (T.R.H.)

5712

SHOCK WAVES IN CONDENSING VISCOUS-PLASTIC MEDIUM. V. N. Kukudzhanov (Moscow Inst. of Physics and Tech.). Izvest. Akad. Nauk Armyan. S.S.R., Ser. Fiz.-Mat. Nauk 11, No. 6, 61-72(1958). (In Russian)

The propagation of shock waves from viscous-plastic deformation is studied in a condensing medium where the initial density of the non-deformed medium is ρ_0 and remains incompressible until the pressure reaches ρ_s. At ρ_s the density jumps to ρ_1 after which it remains constant under increased compression. (R.V.J.)

5713

THERMAL CONDUCTIVITY OF MAGNESIA FROM 1030° TO 1880°C. J. D. McClelland and E. H. Zehms (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Am. Ceram. Soc. 43, 54(1960) Jan. 1.

The thermal conductivity of polycrystalline MgO was measured at 1030 to 1880°C. The results were compared with theoretical data obtained from the empirical expression of McQuarrie and were found to agree quite well if the radiation term of the expression is ignored. (C.J.G.)

5714

CHARACTERISTICS OF A PLASMA THERMOCOUPLE. R. W. Pidd (Univ. of Michigan, Ann Arbor) and G. M. Grover, E. W. Salmi, D. J. Roehling, and G. F. Erickson (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 30, 1861-5(1959) Dec.

The operation of a cesium plasma thermocouple is described for a range of hot-junction temperatures from 1600 to 2600°K and for a range of cesium pressures from 10^{-5} mm Hg to 2 mm Hg. Electromotive force and short-circuit current data are presented for cells containing three different emitter substances: Ta, ZrC, and (ZrC)(UC). In the range of pressure and temperature variation studied, the observed electromotive forces are between 1 and 4.5 volts. Short-circuit current depends markedly on the current emission properties of the hot electrode. The largest short-circuit current density observed for the (ZrC)(UC) emitter, is 62 amperes per square centimeter. (auth)

5715

STUDIES OF COLD CATHODE DISCHARGES IN MAGNETIC FIELDS. John Backus (Univ. of Southern California, Los Angeles). J. Appl. Phys. 30, 1866-9(1959) Dec.

Some experimental studies of a cold cathode discharge in

a strong magnetic field are described. Current densities of the order of half an ampere per square centimeter in various gases were used. For such a discharge, the current to the cathodes is about 75% ionic. Positive ions leaving the discharge by moving across the magnetic field were observed with a mass spectrometer and showed a temperature of about 1 v. Fast electrons from the cathode escape from the discharge across the magnetic field without losing the greater part of their energy. By considering the rate of iron production it is shown that the slow electrons in the discharge have a temperature less than about three volts. Fluctuations in charge densities must play a very important role in the mechanism of the discharge. (auth)

5716

SPACE CHARGE NEUTRALIZATION BY FISSION FRAGMENTS IN THE DIRECT CONVERSION PLASMA DIODE. F. E. Jablonski, C. B. Leffert, R. Silver, R. F. Hill, and D. H. Loughridge (General Motors Research Labs., Warren, Mich.). J. Appl. Phys. 30, 2017-18(1959) Dec.

Calculations are presented which show that fission fragments can produce a partial plasma in a noble gas and that the resistivity (4ohm-cm) of the gas could be low enough to operate the system as a direct conversion plasma diode. (C.J.G.)

5717

CALCULATION OF EFFICIENCY OF THERMOELECTRIC DEVICES. B. Sherman, R. R. Heikes, and R. W. Ure, Jr. (Westinghouse Research Labs., Pittsburgh). J. Appl. Phys. 31, 1-16(1960) Jan.

A procedure was developed for the exact calculation of the efficiency of thermoelectric generators and cooling devices in which the parameters of the materials have arbitrary temperature dependence. High speed computer techniques are found necessary. Approximate methods are reviewed and their discussion extended. A number of examples are worked out by both the exact and approximate methods. Comparison of these results show that the approximate methods agree with the exact method to about 5% in the case of power generation and to about 15% in the case of the refrigeration coefficient of performance. However, in the case of the maximum heat pumping rate deviations as large as a factor of 2 are found. (auth)

5718

WAVES ON A FILAMENTARY ELECTRON BEAM IN A TRANSVERSE-FIELD SLOW-WAVE CIRCUIT. A. E. Siegman (Stanford Univ., Calif.). J. Appl. Phys. 31, 17-26 (1960) Jan.

The waves on a filamentary electron beam in a longitudinal d-c magnetic field, and their interaction with a transverse-field slow-wave circuit, are studied in detail. All quantities are expressed in terms of circular polarization, with the circuit fields having arbitrary polarization. The beam is found to carry four waves: a positively polarized negative-energy slow cyclotron wave, a negatively polarized positive-energy fast cyclotron wave, and two synchronous ($\beta = \beta_e$) waves, one with positive polarization and positive energy, one with negative polarization and negative energy. The coupling of these waves to the circuit is described both in the manner of Pierce's longitudinal traveling wave tube (TWT) analysis and in a coupled-mode description. For the two special cases of positive or negative circularly polarized fields, only the appropriately polarized beam waves couple. A third special case of linear polarization is more complicated, but essentially only the two cyclotron waves couple. In each of the three cases one positive-energy and one negative-energy beam wave is involved. In each case the equations can be made identical with the longitudinal TWT equations. As one example, a positively polarized circuit can be used as a fast-wave coupler for an Adler-type parametric amplifier, and its design becomes formally identical with the longitudinal Kompfner dip problem. Published Kompfner dip data can be used. The beam-circuit interaction is found to be correctly described by considering only the apparent transverse motion of the beam's position, although the actual interaction mechanism involves both the true transverse interaction with the actual transverse electron velocities, and the longitudinal interaction of the d-c beam velocity with the longitudinal a-c fields off the d-c beam axis. The latter leads to changes in longitudinal d-c velocity of the electrons and thus accounts for the negative rf energies of two of the waves. (auth)

5719

DIPOLE MODE OF MINORITY CARRIER DIFFUSION WITH REFERENCE TO POINT CONTACT RECTIFICATION. B. R. Gossick (Arizona State Univ., Tempe). J. Appl. Phys. 31, 29-35(1960) Jan.

The dipole mode of minority carrier diffusion about a spherical emitter is presented. The current-voltage relationship, and frequency characteristics of this mode are determined. Compared with the unipole mode, which was treated extensively, the dipole mode offers superior high-frequency performance, which is partially offset by an inferior d-c characteristic curve. A representative numerical example gives 40 mμsec mean response time with the unipole mode and 0.5 mμsec with the dipole mode. It is proposed that the reproducibility of special diode characteristics might be improved by designing diodes to suppress either the unipole or dipole mode. Methods are suggested for the suppression of either mode. (auth)

5720

SCATTERING BY NONSPHERICAL PARTICLES. J. Mayo Greenberg (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Appl. Phys. 31, 82-4(1960) Jan.

The small angle scattering approximation of Schiff is applied to several nonspherical body shapes. Effects of orientation and elongation are discussed. (auth)

5721

FIELD DEPENDENCE OF PHOTOELECTRIC EMISSION FROM TANTALUM. J. L. Gumnick and D. W. Juenker (Univ. of Notre Dame, Ind.). J. Appl. Phys. 31, 102-8(1960) Jan.

An experimental study is made of the photoelectric emission from tantalum as it depends directly on accelerating electric field. Observations cover a range of fields from 0 to 90 kv/cm and illumination wavelengths from 248 to 300 mμ. The results are in agreement with the Fowler photoelectric theory modified by a Schottky lowering of the surface barrier. No evidence is found for a periodic deviation from this regular behavior such as exists in its thermionic counterpart, but experimental conditions were possibly inadequate for the observation of such a deviation. A new method of threshold measurement at high fields is described and applied to drawn tantalum filaments of circular cross section. The resulting value is 4.16 ev for freshly flashed specimens and it is suggested that this is slightly greater than the lowest work function present in the surface. A Fowler determination in the same field range yields 4.13 ev. The influence of nonuniformity of the surface work function on the field dependence of photoemission and on threshold measurements is discussed. (auth)

5722

FIGURE OF MERIT FOR THERMIONIC ENERGY CONVERSION. N. S. Rasor (North American Aviation, Inc.,

Canoga Park, Calif.). J. Appl. Phys. 31, 163-7(1960) Jan.

The optimum performance for emission-limited thermionic energy conversion is derived in convenient analytical form. The steps which are thereby indicated to reduce fundamental performance limitations are enumerated and briefly discussed. A figure of merit is defined with brief description of its usefulness and significance. A comparison of thermionic and thermoelectric conversion is thereby afforded by the analysis. (auth)

5723

LOW-TEMPERATURE, LOW-PRESSURE TRANSPORT COEFFICIENTS FOR GASEOUS OXYGEN AND SULFUR ATOMS. Daniel D. Konowalow, J. O. Hirschfelder, and Bruno Linder (Univ. of Wisconsin, Madison). J. Chem. Phys. 31, 1575-9(1959) Dec.

The transport properties of a gas at low temperature can be estimated in terms of the potential energy curves at very large separations. For this purpose it is only necessary to know the dispersion and multipole energies of interaction. Such calculations are carried out for the interaction of two oxygen or two sulfur atoms in their ground states. The atoms have an a priori probability p_i of interacting in accordance with one of a set of potential energy functions $\Phi_i(R)$, where p_i is proportional to the sum of the degeneracies of the states of the collision complex to which $\Phi_i(R)$ applies. For such collisional problems involving more than one potential energy function, the collision cross section Q for any process is rigorously additive in the sense that $Q = \Sigma_i p_i Q_i$, where Q_i is the collision cross section considering only the ith potential. (auth)

5724

TOTAL COLLISION CROSS SECTIONS FOR THE INTERACTION OF ATOMIC BEAMS OF ALKALI METALS WITH GASES. Erhard W. Rothe and Richard B. Bernstein (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 31, 1619-27(1959) Dec.

Total collision cross sections (Q) for the interaction of atomic beams of K and Cs with a number of molecules were measured with an apparatus of 30 in. angular resolution. Although absolute determinations of Q are difficult, relative values are readily obtained (±3%). Results are reported as the ratio (Q*) of the cross section for a given molecule to that of argon for the same beam atom. Seventy-seven molecules (of varied complexity and reactivity) were studied with K and 16 with Cs beams. Q* ranged from 0.29 to 2.8. The data were correlated using the Massey-Mohr theory, assuming an attractive intermolecular potential $V(r) = -C/r^6$. For this case $Q = b\,(C/v_r)^{1/4}$, where v_r is the relative velocity and b a known constant. C was estimated from standard formulas for the London dispersion and dipole-induced dipole forces, using known refraction and dipole moment data. The theoretical values of Q differ by a nearly constant factor from the experimental results; thus values of Q* are predicted with good accuracy. The deviation between Q_{calc}^* and Q_{obs}^* was < ±3% for 57% (and < ±10% for 87%) of the molecules. Most of the large deviations occurred for the light gases. (auth)

5725

FREE VOLUME THEORY FOR SQUARE-WELL POTENTIALS. Berni J. Alder (Univ. of California, Livermore). J. Chem. Phys. 31, 1666-74(1959) Dec.

The thermodynamic functions are tabulated for molecules interacting with a square-well potential over a wide region of temperature and density by a straightforward application of the free volume theory. (auth)

5726

EXCITATION FUNCTION OF HELIUM 3^1P FOR ELECTRON COLLISIONS. Robert M. St. John, Charles J. Bronco, and R. G. Fowler (Univ. of Oklahoma, Norman). J. Opt. Soc. Am. 50, 28-32(1960) Jan.

The function for the excitation of the helium 3^1P level by electron impact was determined optically. Light intensity of the $3^1P \rightarrow 2^1S$ transition (5016 A) was detected by a sensitive photomultiplier; its output was measured by a microammeter. The intensity of the 5016 A line was proportional to electron beam current for all currents used and proportional to helium pressure for less than 3×10^{-4} mm. Above 3×10^{-4} mm pressure imprisonment of resonance radiation enhanced the light intensity. The excitation function has a peak value of 2.4×10^{-18} cm^2 which occurs at an electron energy of 100 ev. Absolute determination of the cross section was possible through the calibration of the light detection system by a tungsten ribbon standard lamp. The experimental curve is corrected by removing cascade components from it. (auth)

5727

RELATIVE INTENSITIES OF ZEEMAN COMPONENTS IN NUCLEAR QUADRUPOLE RESONANCE SPECTRUM. Masaharu Toyama (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1727-38(1959) Dec. (In English)

The transition probabilities for the Zeeman components in nuclear quadrupole resonance spectrum were formulated in the case of arbitrary field gradient. For a nucleus of half-integral spin the rule for $\eta = 0$ holds approximately for small asymmetry in the case when the direction of the Zeeman field is not too close to the principle xy-plane. When a magnetic field is applied in a direction perpendicular to the principal z-axis in the case of nonaxial field gradient due to the surrounding charges, the inner pair of the Zeeman components is produced by the x-component of the r-f field and the outer pair by the y-component. The dependence of the intensities on the Zeeman field is in general not symmetric with respect to the principal axes of the field gradient. (auth)

5728

DECAY PROPERTIES OF ZnS(Ag) PHOSPHORS. Tsunesaburo Asada, Masayoshi Masuda, Masayuki Okumura, and Juzo Okuma (Univ. of Osaka). J. Phys. Soc. Japan 14, 1766-70(1959) Dec. (In English)

Measurements of the decay properties of ZnS(Ag) phosphors are reported for various forms of radiation. It was found that the phosphor has two types of decay mode for a specific kind of radiation, one being exponential and the other hyperbolic with time, and that the phosphor has different decay constants in the exponential form of decay for different kinds of radiation. The decay constants were found to be 100 mμsec and 10 mμsec for the α-particle and γ-ray excitation, respectively. It was observed that in the case of γ-ray excitation the decay is mainly exponential and in the case of α-particle excitation mainly hyperbolic. The difference of decay modes and the difference of the decay constants make it possible to discriminate protons or α-particles from the strong γ-ray background. (auth)

5729

THERMODYNAMIC PROPERTIES OF HYDROGEN AND DEUTERIUM AT TEMPERATURES BETWEEN -175°C AND 150°C AND AT DENSITIES UP TO 840 AMAGAT. A. Michels, W. De Graaff, and G. J. Wolkers (Gemeente Universiteit, Amsterdam). Physica 25, 1097-1124(1959) Nov. (In English)

From compressibility isotherms of hydrogen and deuterium published previously, caloric and thermal functions were calculated for the normal and equilibrium ortho-para concentrations. These properties are the energy, entropy, free energy, enthalpy, free enthalpy, internal kinetic energy, specific heats, speed of sound, and Joule-Thomson coefficient. The data are presented at integral values of density and temperature. The results for the Joule-Thomson coefficient were compared with literature data. (auth)

5730

A VACUUM DISTILLATION CAMERA USING RADIOACTIVE-METAL SOURCE. Luther E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). Nucleonics 18, No. 1, 102-3(1960) Jan.

A vacuum-distillation camera is used to investigate the properties of the metal source—e.g., whether it is a true point source, as well as the amount of creep and of elastic scatter of the distilling metal atoms. When the distilling source is charged with a radioactive material, a radioactive image will condense on the target plate. The radioactive technique permits the study of distillations of about a milligram of charge. (B.O.G.)

5731

THE NEUTRON—PHONON INTERACTION IN SOLIDS. Bronisław Buras and Denis O'Connor (Inst. of Nuclear Research, Warsaw). Nukleonika 4, 119-40(1959). (In English)

A description is given of the main features of the interaction of thermal neutrons with crystal lattice vibrations. Experimental methods used in the study of this problem are compared, and recent work using these methods is reviewed. Some details of apparatus built in the present study are given. (auth)

5732

RELATIVISTIC INCREASE OF IONIZATION IN XENON. A. Rousset, A. Lagarrigue, P. Musset, P. Rançon, and X. Sauteron (Ecole Polytechnique, Paris). Nuovo cimento (10) 14, 365-75(1959) Oct. 16. (In English)

The relativistic increase of ionization in various gaseous mixtures was studied by the method of drop-counting in a cloud chamber. If ρ is designated the relative ionization of $\beta/\sqrt{1-\beta^2}$ (equal to 300), it is found that in pure xenon or mixtures of xenon and hydrogen, ρ is of the order of 1.7. The value of ρ drops to 1.3 if helium is mixed with xenon. (auth)

5733

ON THE ANALYTIC PROPERTIES OF PARTIAL WAVE SCATTERING AMPLITUDES OBTAINED FROM THE SCHRÖDINGER EQUATION. A. Martin (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 403-25(1959) Oct. 16. (In English)

The behavior of the radial reduced wave function was studied by means of the Schroedinger equation for complex values of momentum k. In the case of infinite range potentials, the study is restricted to the s wave. The anomalous poles in the upper plane lie outside the imaginary axis for the oscillating potential. The complete analytic behavior for the Yukawa potential and generalization, including behavior at infinity, is described. The analytic properties are given of a quantity related to the wave function at a fixed point r, giving rise to generalized dispersion relations. (C.J.G.)

5734

ADIABATIC PASSAGES IN NUCLEAR MAGNETIC RESONANCE WITH THE ROTATING CO-ORDINATE METHOD. G. Bonera and L. Giulotto (Università, Paris). Nuovo cimento (10) 14, 435-42(1959) Oct. 16. (In English)

The cases of adiabatic passages in nuclear magnetic resonance are studied with the rotating coordinate method. The expressions for the corresponding nuclear signals, already found by Bloch, are rederived by this method. A simple geometrical model, which describes the movement of the nuclear magnetization during a slow passage, is derived. The application of the rotating coordinate method for simultaneous treatment of the oscillating magnetic field effect and the relaxation effect is demonstrated. (auth)

5735

REMARKS ON THE COVARIANT HAMILTONIAN FORMALISM FOR VECTORIAL FIELDS. R. S. Liotta (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 14, 443-7(1959) Oct. 16. (In English)

A covariant Hamiltonian formalism was developed for the vectorial meson field and electromagnetic field based on a Lagrangian equation. (C.J.G.)

5736

SOFT X-RAY EMISSION SPECTRA FROM LITHIUM AND LITHIUM—MAGNESIUM ALLOYS. J. A. Catterall and J. Trotter (National Physical Lab., Teddington, Middx., Eng.). Phil. Mag. (8) 4, 1164-70(1959) Oct.

An examination of the emission spectra from lithium and lithium-magnesium alloys has indicated that in the alloys electron transfer takes place from magnesium to lithium. The shape of the high-energy edge of the lithium K emission spectrum could be explained by broadening of the 1s ionic level in the crystal. (auth)

5737

THE STATISTICAL THERMODYNAMICS OF A GAS WITH LONG AND SHORT-RANGE FORCES. S. F. Edwards (Univ. of Manchester, Eng.). Phil. Mag. (8) 4, 1171-82(1959) Oct.

If a gas has long-range Coulomb interactions and short-range interaction, e.g., hard core repulsions, three lengths enter the problem: the radius of the repulsive core, d, the mean interparticle distance, r_0, and λ_D the Debye-Huckel radius, $(8\pi Ne^2/VkT)^{-\frac{1}{2}}$. A method was presented of obtaining the equation of state when, in the first instance $\lambda_D \gg r_0 \gg d$, which enables one to obtain higher-order terms in a simple way, and these are calculated. In order to relax the condition $\lambda_D \gg r_0$, a variational method is employed which shows that the usual Debye—Huckel theory makes the grand thermodynamic potential an extremum, the exact result lying between the perfect gas and the Debye—Huckel gas. The results enable one to estimate the contributions to the virial expansion of collective oscillations and of shielded particle encounters, while avoiding difficulties such as are associated with redundant coordinates. The extension of the results to the quantum mechanical case are briefly commented upon. (auth)

5738

CURRENT TRANSITIONS IN SUPERCONDUCTIVE TIN FILMS. J. W. Bremer and V. L. Newhouse (General Electric Co., Schenectady, N. Y.). Phys. Rev. 116, 309-13(1959) Oct. 15.

Except at temperatures just below the critical temperature the change of resistance of a superconducting film if the current through it is increased slowly takes place by a discontinuous transition, exhibits hysteresis, and is dominated by Joule heating effects. By applying current in short pulses, it was possible to obtain isothermal transitions in films deposited on a flat surface. These transitions are smooth, do not exhibit hysteresis, and have a shape independent of film resistance. The critical current I in films

of thickness about twice the penetration depth is proportional to film width and can be related to the critical field of the film H_C and the bulk critical field H_{CB}, by the relation $IH_C = const H_{CB}$. It is also shown that by calculating the conditions of thermal equilibrium the dc transition curves with Joule heating can be derived from the isothermal transition results. (auth)

5739

ENERGY LEVELS IN NEUTRON-IRRADIATED n-TYPE SILICON. G. Rupprecht and C. A. Klein (Raytheon Co., Waltham, Mass.). Phys. Rev. 116, 342-3(1959) Oct. 15.

Pulsed-field effect experiments were performed on neutron-irradiated n-type silicon samples with the aim of detecting deep-lying radiation-induced energy levels and estimating their electron capture cross sections. These experiments provide evidence in favor of two, deep-lying states in the upper part of the energy gap, at 0.15 ev and 0.37 ev below the conduction band edge. The electron capture cross sections associated with these two levels strongly suggest that both are acceptor-like. (auth)

5740

THERMODYNAMIC PROPERTIES OF MOLECULAR NITROGEN. Václav Konečný (Vysoká škola strojní a elektrotechnická, Plzeň, Czech.). Jaderná energie 5, 336-9(1959) (In Czech.)

The characteristics of some important properties of molecular nitrogen—derived from the literature date—are plotted in graphs and tables. (auth)

5741

THE POSSIBLE SUPERFLUID BEHAVIOUR OF HYDROGEN ATOM GASES AND LIQUIDS. Charles E. Hecht (Univ. of Chicago). Physica 25, 1159-61(1959) Nov. (In English)

The de Boer theory of corresponding states has been suggested as a means of predicting the properties of hydrogen, deuterium, and tritium atoms. A discussion of the thermodynamic properties would be possible if the electronic spins of the atoms could be made parallela dn could be prevented from recombining. The results of using the quantum mechanical corresponding states theory are given and compared with values for He^3 and He^4. Equations are presented for calculating the λ point of a liquid assembly of bosons (H and T atoms) and also for H and T atoms separately. (B.O.G.)

5742

A CALCULATION OF THE THERMODYNAMIC PROPERTIES OF He^3–He^4 SOLUTIONS. R. de Bruyn Ouboter, J. J. M. Beenakker, and K. W. Taconis (Kamerlingh Onnes Laboratorium, Leiden). Physica 25, 1162-76(1959) Nov. (In English)

The existing vapor-liquid equilibrium data on He^3–He^4 mixtures are analyzed. From the vapor pressure measurements of Roberts and Sydoriak the change of the excess chemical potentials with concentration was calculated in the temperature region between 0.6 and 2°K. Below 1°K the mixture seems to behave as a regular solution. (auth)

5743

LOW TEMPERATURE RESISTIVITY OF PLUTONIUM AND NEPTUNIUM. J. A. Lee (Atomic Energy Research Establishment, Harwell, Berks, Eng. and Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 74, 671(1959) Nov. 1.

At a temperature of 0.75°K the measured residual resistance for Pu was 14×10^{-2} and for Np was 3.1×10^{-2} of the room temperature value. (B.O.G.)

5744

THE GENERATION OF DIRECT CURRENT AT HIGH POTENTIALS. W. E. Bennett (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Research (London) 12, 455-9(1959) Dec.

A description of a small ionized-gas, high-voltage generator to produce a direct current at high potential is given. The applications of such a generator in fission reactors, fusion research, and radiography are discussed. (C.J.G.)

5745

SCINTILLATIONS FROM LIQUID HELIUM. H. Fleishman, H. Einbinder, and C. S. Wu (Columbia Univ., New York). Rev. Sci. Instr. 30, 1130-1(1959) Dec.

The scintillations of liquid helium due to U-233 α-particles were observed and compared with scintillations from a CsI crystal. The source was placed at distances of d < 0.05, 1.0, and 1.9 cm from the detector. (C.J.G.)

5746

GAMMA AND X-RAY EFFECTS ON ELECTRIC PROPERTIES OF CdS AND CdSe. M. A. Talibi. Trudy Inst. Fiz. i Mat. Akad. Nauk Azerbaĭdzhan. S.S.R., Ser. Fiz. 9, 10-19(1958). (In Azerbaidzhani)

Investigations show that with both high-energy quanta and visual light the effects of radiation on the electroconductivity of semiconductors are determined by the behavior of the current carriers liberated as a result of ionization, and not by the character of the ionization process itself. (R.V.J.)

5747

DELAYED LIGHT-EMISSION OF SCINTILLATORS IN THE MICROSECOND REGION. Klaus Einfeld (Universität, Göttingen, Ger.). Z. Naturforsch. 14a, 966-71(1959) Nov. (In German)

The delayed light emission of scintillators used in nuclear physics was determined in the region between 0.05 μsec to 400 μsec by a new method. The materials studied were liquid scintillators, plastic scintillators, anthracene, NaI(Tl), and CsI(Tl). For stimulation of the scintillators a repeated periodic x-ray pulse of 0.05 μsec duration was used. The light-intensity measurements were made by direct current measurements of a photo-multiplier made sensitive only for 0.05 μsec time intervals by electronic control. The decay curves of light emission were analyzed as a sum of exponential functions, for which the decay times and relative light intensities were determined in relation to the principle pulse. (tr-auth)

5748

ORIENTATION DEPENDENCE OF SCINTILLATION LIGHT YIELD OF ANTHRACENE IN IRRADIATION BY ALPHA PARTICLES. Paul Henrich Heckmann. (Universität, Göttingen, Ger.). Z. Physik 157, 139-48(1959) Oct. (In German).

The scintillation response of anthracene crystals to α-particles depends on their direction of incidence with respect to the crystal axes. The response is maximal in the direction perpendicular to the main cleaving plane ab and minimal in the direction parallel to the axis a, the quotient of maximum and minimum response being about 1.55 at an energy of 5.3 Mev and increasing with decreasing energy of the α-particles. A formula based on simple assumptions is derived, which described correctly the measured angular dependence. (auth)

5749

MEASUREMENT OF STORED ENERGY IN QUENCHED CONDENSED COPPER AT LOW TEMPERATURES. Winfried Mönch and Wilhelm Sander (Universität, Göttingen, Ger.). Z. Physik 157, 149-58(1959) Oct. (In German)

Copper films are produced by quenching condensation

on a substrate at low temperature. A stored energy release of 216 cal/mole and a resistivity decrease of 1.8 μohm-cm are observed during annealing from 20 to 60°K. In this temperature range the recovery of the films is described by a crystallization of highly disordered material between small crystallites, which are produced during condensation. About 14 at.% of the whole film substance take part in this process. The stored energy–resistivity ratio E/Δ_ρ found is 1.9 cal/g/μohm-cm in the whole temperature range from 20 to 60°K. This value is in good agreement with the stored energy measurements on neutron-bombarded copper. (auth)

5750

PECULIARITIES IN MAGNETIC HYSTERESIS OF $Pr_2O_3 \cdot Fe_2O_3$ and $La_2O_3 \cdot Fe_2O_3$. K. P. Belov, M. A. Zaitseva, and A. M. Kadomtseva (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1159-61(1959) Oct. (In Russian)

Peculiar hysteretic properties were studied with specimens of $Pr_2O_3 \cdot Fe_2O_3$ and $La_2O_3 \cdot Fe_2O_3$ of stoichiometric content and with an excess of iron oxide prepared by the standard ceramic technology. The temperature dependence of the specific magnetization of $Pr_2O_3 \cdot Fe_2O_3$ in a 5500 gauss field and the hysteresis loops for the stoichiometric ferrite and for $Pr_2O_3 \cdot 1.67\ Fe_2O_3$, as well as for $La_2O_3 \cdot Fe_2O_3$, are plotted before and after cooling. (R.V.J.)

5751

APPLICATIONS OF DISPERSION CORRELATIONS FOR CORRECTIONS IN QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES. I. S. Zlatev and P. S. Isaev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1161-2(1959) Oct. (In Russian)

Generalized diagrams, types 3 and 4, are considered in addition to the Bethe-Heitler type 1 and 2 diagrams in studies of the electron energy and γ quanta >150 Mev in bremsstrahlung and pair production processes. The Bogolyubov method of dispersion relations was used in calculating the type 3 and 4 diagrams. Calculations of the type 1 diagram, the single nucleon approximation type 5 diagram interference term, and an approximate evaluation of the single pion contribution were used for the bremsstrahlung process. It was shown that at ~30°, when photon, electron, and proton pulses in their ultimate states are found in the same plane, the initial electron energy is 0.54, the photon energy is 0.25 (in units of $\hbar = c = M = 1$, M being the nucleon mass), and the quantum electrodynamics can be corrected within a distance $\geq 3 \times 10^{-14}$ cm. An acute and high maximum exceeding the Bethe-Heitler cross section by an order of 3 to 4 was observed in the single-nucleon and interference terms of bremsstrahlung cross section. The maximum becomes even more acute with a drop in γ energy. (R.V.J.)

5752

TWO-BODY EXCITATION OF SUPERFLUID FERMI SYSTEMS. Yu. V. Tsekhmistrenko (Inst. of Physics, Academy of Sciences, Ukrain. SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1164-6(1959) Oct. (In Russian)

A method is offered for deriving a closed system of equations for developing the two-body Green's function using the Bogolyubov formalism of u, v transposition. (R.V.J.)

5753

MANUAL OF MATHEMATICAL PHYSICS. Paul I. Richards. New York, Pergamon Press, 1959. 496p. $17.50.

Formulas and statements are presented which are either basic to theoretical physics or useful in many applications. The special cases of physical theory covered include mechanics, thermodynamics, electromagnetic theory, relativity, quantum mechanics, and statistical physics. The associated mathematics begins with algebra and extends through unitary spaces, eigenvalue problems, probability and game theory, tensor analysis, and group theory. (C.J.G.)

Astrophysics and Cosmology

5754

TWO ANOMALIES IN THE BEHAVIOUR OF THE F2 LAYER OF THE IONOSPHERE. Sheila Croom, Audrey Robbins, and J. O. Thomas (Cavendish Lab., Cambridge, Eng.). Nature 184, Suppl. No. 26, 2003-4(1959) Dec. 26.

The anomalous behavior of the F2 layer in the ionosphere is discussed relative to the "geomagnetic anomaly" pointed out by Appleton (the curve of f_0F_2 plotted against magnetic dip shows a trough extending roughly over the magnetic latitudes ±20°) and an unexpected diurnal asymmetry (observed at 09.00 and 15.00 hr local time world-wide). The electron distributions (N(h) curves) were determined for the two situations. (C.J.G.)

5755

THE TEMPERATURE REQUIRED FOR NUCLEAR REACTIONS IN COSMICAL ELECTRICAL DISCHARGES. C. E. R. Bruce (Electrical Research Assn., Leatherhead, Surrey, Eng.). Nature 184, Suppl. No. 26, 2004-5(1959) Dec. 26.

The temperatures required for nuclear reactions in cosmic electrical discharges such as long-period variable stars, the combination spectra star AX Persei, and extragalactic nebulae are calculated and compared to observed values. Gas and electron velocities associated with these reactions at high temperatures are calculated. (C.J.G.)

5756

THE TRITIUM–HELIUM AND POTASSIUM–ARGON AGE OF THE RAMSDORF METEORITE. K. Goebel and P. Schmidlin (CERN, Geneva) and J. Zahringer (Max-Planck-Institüt für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 14a, 996-8(1959) Nov. (In German)

The radiation-age of the Ramsdorf meteorite (July 26, 1958) was measured and discussed. A T determination was made by melting in vacuum to separate T, and counting in a Geiger-Mueller tube. The T–He age was 4×10^8 years. The K–Ar age, determined by mass spectroscopic analysis of the rare-gas content, was 370×10^8 years. Ages of other meteorites range from 10 to 1000 times greater than this. (T.R.H.)

5757

EMISSION OF NEUTRINO PAIRS BY ELECTRONS AND ITS IMPORTANCE IN STARS. G. M. Gandel'man and V. S. Pinaev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1072-8(1959) Oct. (In Russian)

The bremsstrahlung emission of neutrino pairs proposed by Pontecorvo is considered. At certain high values of density and temperature neutrino-pair energy losses may be larger than the amount of energy which is carried off as a result of radiative thermal conduction. Neutrino cooling may be significant and in some cases even of decisive importance for the theory of white dwarfs and star evolution and especially of the dynamics of supernovae explosions. The process under consideration leads to larger energy losses than those expected on the basis of the neutrino production process in the nuclear reaction proposed by Gamov and Shonberg in 1941. (auth)

Cosmic Radiation

5758

AN INTERACTION OF NUCLEONS AT AN ENERGY BETWEEN 10^{14} AND 10^{15} ev NUCLEON. Jaroslav Pernegr, Václav Petržílka, and Jiří Vrána (Czechoslovak Academy of Sciences, Prague and Charles Univ., Prague). Czechoslov. J. Phys. 8, 137-47(1958). (In English)

A (0 + 14)α jet with primary energy $(3.3^{+1.3}_{-1.3}) \times 10^{14}$ ev/nucleon was observed in the "I" stack. An interaction with very small multiplicity (n_s = 3 or 4) found in the axis of the jet is probably caused by another nucleon from the α primary. Ten particles of the narrow cone have opening angles of some 10^{-4} radians, 4 particles in the diffuse cone are emitted at angles of a few 10^{-2} radians. A pronounced anisotropy exists in the cms. The coefficient of inelasticity ≈0.1 was calculated directly extrapolating the measured energies of secondaries. The interpretation of the whole event is in good agreement with Heisenberg's theory of multiple production of particles. (auth)

5759

PROBLEMS IN THE INTERPRETATION OF COSMIC RAY NUCLEAR INTERACTIONS. Kurt Sitte (Technion-Israel Inst. of Tech., Haifa, Israel). Czechoslov. J. Phys. 9, 271-87(1959). (In English)

Difficulties in the interpretation of high-energy nuclear interactions are discussed and explanations suggested on the basis of successive or composite nucleon-nucleus collisions. In the energy region up to about 10^{11} ev some discrepancies in the frequency of production of strange particles and the small interaction cross-section of iron are explained, taking into account secondary intranuclear collisions. The "tunnel" model of Heitler and McCusker is replaced by assuming a cone-shaped interaction volume ("funnel") even at the highest primary energies. A number of consequences concerning the energies of the primary particles, such as the multiplicity and asymmetry in the angular distribution of secondaries, and coefficient of inelasticity, are discussed. (auth)

5760

THREE VARIATIONS IN THE INTENSITY OF COSMIC RADIATION IN THE FIRST HALF OF 1958. J. Hladký, P. Chaloupka, V. Kadečka, and P. Mokrý (Inst. of Physics, Czechoslovak Academy of Sciences, Prague) and T. Kowalski (Academy of Mining and Smelting Work, Krakow). Czechoslov. J. Phys. 9, 432-8(1959). (In English)

The time courses are given of three variations in the intensity of cosmic radiation, which occurred in the first half of 1958. The measuring apparatus is described and the energies of the particles recorded are estimated. (auth)

5761

GENERATION OF FAST DEUTERONS IN LEAD AND COPPER BY THE NUCLEON COMPONENT OF COSMIC RADIATION. G. V. Badalyan. Izvest. Akad. Nauk Armyan. S.S.R., Ser. Fiz.-Mat. Nauk 11, 97-111(1958). (In Russian)

In investigations of cosmic deuterons and deuterons generated by the nuclear-active component of cosmic radiation at 160 to 460 Mev, 104 generated deuterons were recorded. Sixty eight were produced in lead and 34 in copper. Simultaneously, ~800 generated protons which stopped in the same track range were recorded. The number of generated deuterons is higher than the average observed cosmic deuterons (81) and is 13% of the number of generated protons. Studies are made of 96 generated deuterons with masses 3000 to 5000 m_e. The mechanism of deuteron formation by neutral and charged cosmic particles, the pulse spectrum in deuteron production, and the cross sections of deuteron production are analyzed. (R.V.J.)

5762

AN INTERPRETATION OF 550 M_e PARTICLES. Masafumi Inoki (Yamanashi Univ., Kofu City, Japan). J. Phys. Soc. Japan 14, 1832-3(1959) Dec. (In English)

An explanation is offered for the failure of several authors to detect 550 M_e particles. It is suggested that the 550 M_e particles are particles charged with $(Z = \frac{1}{3})e$. (C.J.G.)

5763

HEAVY NUCLEI IN THE PRIMARY COSMIC RADIATION AT PRINCE LABERT, CANADA. I. CARBON, NITROGEN, AND OXYGEN. H. Aizu, Y. Fujimoto, S. Hasegawa, M. Koshiba, I. Mito, J. Nishimura, and K. Yokoi (Univ. of Tanashi, Tokyo) and Marcel Schein (Univ. of Chicago). Phys. Rev. 116, 436-44(1959) Oct. 15.

A stack of G-5 emulsion, exposed at 120,000 feet for 8 hours at 61°N was used to study the charge and energy spectrum of heavy nuclei at the low-energy end. Energy measurements were made on C, N, and O nuclei up to 1 Bev/nucleon. The spectrum shows a broad maximum at 550 Mev/nucleon, extrapolated to the top of the atmosphere. Various possibilities to explain this spectrum are discussed. However, it seems desirable to determine the energy spectrum of the other heavy-nuclei components in this energy region in order to gain a more complete understanding of the whole problem. Measurements of this kind are in progress and will be reported. (auth)

5764

COSMIC-RAY NEUTRON ENERGY SPECTRUM. Wilmot N. Hess, H. Wade Patterson, and Roger Wallace (Univ. of California, Berkeley) and Edward L. Chupp (Univ. of California, Livermore). Phys. Rev. 116, 445-57(1959) Oct. 15.

The cosmic-ray neutron energy spectrum in the equilibrium region of the atmosphere was measured with several different calibrated detectors from thermal energies to about 1 Bev at 44° north magnetic latitude and up to 40,000 feet. By combination of the data from these measurements with those from other experiments, a complete differential energy spectrum is obtained which shows the characteristic maximum near thermal energies and a roughly 1/E variation up to about 100 kev. The presence of a second maximum in the spectrum near 1 Mev is attributed to the evaporation neutrons from stars, and above this energy up to 800 Mev the spectrum falls off as $E^{-1.4}$. (auth)

5765

SUDDEN INCREASE OF COSMIC-RAY INTENSITY. Hugh R. Anderson (California Inst. of Tech., Pasadena). Phys. Rev. 116, 461-2(1959) Oct. 15.

A sudden 30% increase in cosmic-ray intensity lasting approximately 12 minutes was observed at an atmospheric depth equal to 80 g/cm² by a Neher integrating ionization chamber flown from Bismarck, North Dakota on October 16, 1958. A similar measurement made simultaneously at Invercargill, New Zealand observed no increase. These observations are not in accord with the simple solar impact zone theory. (auth)

5766

PRIMARY COSMIC-RAY INTENSITY NEAR SOLAR

MAXIMUM. Frank B. McDonald (State Univ. of Iowa, Iowa City). Phys. Rev. 116, 462-3(1959) Oct. 15.

Measurements of the primary cosmic-ray proton and alpha-particle fluxes and energy spectra were extended to the recent period of solar maximum. While the rigidity dependence of both components changed greatly during the solar cycle, it is observed that alpha particles and protons maintain the same relative rigidity spectra during the solar cycle. Measured geomagnetic cutoff values are in agreement with those obtained at solar minimum. An electric field model gives excellent agreement for the general form of the long-term change. However, at low rigidities this model predicts a splitting of the proton and alpha-particle differential rigidity spectra which is not observed. (auth)

5767

DOPPLER-SHIFTED CYCLOTRON FREQUENCY RADIATION FROM PROTONS IN THE EXOSPHERE. W. B. Murcray and J. H. Pope (Univ. of Alaska, College). Phys. Rev. Letters 4, 5-6(1960) Jan. 1.

It was recently suggested that the phenomenon "Dawn chorus" may be due to Doppler-shifted radiation from protons rotating about the lines of force of the earth's magnetic field. This suggestion was investigated and a theoretical chorus dispersion was found to compare favorably with an audio spectrogram of the chorus. Chorus was observed usually in a frequency range 1 to 4 kc although it was observed below 1 kc and above 10 kc occasionally. (B.O.G.)

5768

ON THE STRUCTURE OF EXTENSIVE COSMIC RAY AIR SHOWERS: THE PENETRATING COMPONENT. E. W. Kellermann and N. Dickinson (Univ. of Leeds, Eng.). Proc. Phys. Soc. (London) 74, 554-60(1959) Nov. 1.

The penetrating components of extensive cosmic-ray showers of sizes ranging from 4×10^4 to 5×10^5 particles were examined at distances from 3 to 18 metres from the shower cores. Within these distances the nucleonic particles, 2 Bev or larger, examined have a lateral distribution not flatter than that of the electrons which is described by a power law $r^{-0.75}$ whereas the muon component decreases as $r^{-0.3}$ with distance from the core. The numbers of nucleonic particles and muons decrease relative to the electron numbers N with increasing shower size, the number of nucleons being proportional to $N^{0.6}$. (auth)

5769

SIDEREAL ANISOTROPY IN HIGH ENERGY COSMIC RAYS. I. Escobar V., N. Nerurkar, and R. Weil (Laboratorio de Física Cósmica de Chacaltaya, La Paz, Bolivia and Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro). Rev. mex. fis. 8, 87-100(1959). (In Spanish)

An experiment to investigate extensive cosmic showers corresponding to primary energies of 10^{14} and 10^{15} ev were made at the top of Chacaltaya (5220 m above sea level at latitude 16°S) with coincidences between banks of counters separated by a distance of 20 m. There is evidence of a sidereal anisotropy of the order of 1.6% with the maximum approximately at 1400 hours local sidereal time. The barometric coefficient with respect to the absorption curve for the extensive showers was also studied. (tr-auth)

5770

DAILY VARIATIONS IN THE INTENSITY OF COSMIC RAYS MEASURED WITH DIRECTIONAL TELESCOPES IN CHACALTAYA. I. Escobar V., C. Uría, and R. Weil (Universidad Mayor de San Andrés, La Paz, Bolivia and Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro). Rev. mex. fis. 8, 101-15(1959). (In Spanish)

An experiment with twin telescopes without absorbent and directed to 45° east and west was made in Chacaltaya. From a 5-month study it was concluded that the principal factor in the variation observed is the pressure fluctuations. By making the barometric correction and eliminating the meteorological factors causing a difference in the east and west telescopes, a daily variation of the primary energy was found of the order of 0.3% with a maximum at 1200 hours and a minimum at 2000 hours. The data appear to indicate that the primary particles of low energy which cause the radiation recorded with the west telescope are dispersed by the extraterrestrial magnetic fields. (tr-auth)

5771

ARGON-39 AS THE REACTION PRODUCT OF COSMIC RADIATION IN IRON METEORITES. H. Wänke and Else Vilcsek (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 14a, 929-34(1959) Nov. (In German)

A description is given of the separation and measurement of Ar^{39} which is produced in iron meteorites by the action of cosmic radiation on Fe nuclei. Of the three meteorites studied, only Treysa had a measurable Ar^{39} activity. For the instant of descent of Treysa a decay rate of 0.36 ± 0.2/kg-sec was obtained. The negative results for the Carbo and Clark County meteorites show that their instant of descent must be put back 1000 years. From these measurements the radiation age of Treysa can be set at 6×10^8 years. Further, for the cosmic radiation intensity for particles over 1-Bev energy a value of $I_0 = 0.25 \pm 0.07$ particles/cm^2/sec/sterad results. (tr-auth)

5772

INVESTIGATION OF HIGH ENERGY NUCLEAR-ACTIVE PARTICLES AT SEA LEVEL. V. A. Dmitriev, G. V. Kulikov, and G. B. Khristiansen (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 893-905 (1959) Oct. (In Russian)

Large bursts in an ionization chamber located under a filter which is efficient with respect to nuclear interactions are studied. It is shown that at sea level the majority of the big bursts ($\geq$ 1000 relativistic particles) are caused by interactions in the filter of nuclear-active particles with energies $E \geq 10^{12}$ ev. The spectrum of the nuclear-active particles and their air accompaniment are presented. The accompanying particles can be explained by fluctuations in the development of the nuclear cascade in the atmosphere. The cross section for interaction of $\sim 10^{13}$ ev particles with nuclei of atmospheric atoms is estimated. Cases of high energy nuclear-active particle beams were observed. (auth)

5773

ON THE THEORY OF PASSAGE OF NUCLEAR CASCADES THROUGH THE ATMOSPHERE. I. P. Ivanenko (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1046-9(1959) Oct. (In Russian)

A method for solution of the equations describing the passage of nuclear cascades through the atmosphere is proposed. The boundary conditions can be prescribed at an arbitrary depth. The proposed method permits one to obtain the solution in a form similar to that obtained by the usual method of successive generations with boundary conditions prescribed at the top of the atmosphere. The form of the solutions for various types of boundary conditions is considered. (auth)

Criticality Studies

5774 HW-61931

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

MINUTES OF CRITICALITY INSTRUMENTATION MEET-

ING, HANFORD ATOMIC PRODUCTS OPERATION, AUGUST 17 AND 18, 1959. C. L. Brown. Sept. 16, 1959. 13p. Contract W-31-109-Eng-52. OTS.

A criticality instrumentation meeting was held at Hanford on August 17 and 18, 1959. The meeting was attended by instrumentation and criticality specialists from the primary AEC sites. The talks presented served to acquaint those present with the efforts and problems associated with criticality alarm systems now in use at each site and the development work being directed toward perfecting more adequate systems. A brief résumé of each talk is given. (W.D.M.)

5775 HW-62031

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A COMPARISON OF PCTR AND CRITICAL EXPERIMENT DETERMINATIONS OF k_∞ FOR TWO WEIGHT PER CENT URANIUM-235 ENRICHED UF_4 IN PARAFFIN. V. I. Neeley. Sept. 22, 1959. 28p. Contract AT(45-1)-1350. OTS.

The value of k_∞ for 2 wt.% U^{235} enriched UF_4 paraffin moderated at a H/U^{235} atomic ratio of 195 was determined in the PCTR. This material was returned to ORNL in order that critical experiments might be conducted to determine k_∞. The two values of k_∞ were then compared. The value of k_∞ as determined in the PCTR was dependent upon the cross-section values which were chosen. In this experiment "effective" cross-section values obtained by averaging the cross section over the Wigner-Wilkens spectrum of a similar type of mixture were used. The value of k_∞ determined in the PCTR was 1.216 ± 0.013. The value obtained from the work carried out at ORNL was 1.200 ± 0.011 from a one-group treatment of the critical experiments and 1.202 ± 0.012 from a two-group treatment of the work. A theoretical calculation of k_∞ gives a value of 1.23. This is in good agreement with the experimental value. Critical experiments done on this material at ORNL show that the minimum critical mass for a bare "square" cylinder contains approximately 28 kg of U^{235}. A calculated value of the amount of U^{235} in a just critical bare square cylinder was obtained using the experimental k_∞ value. Again there was good agreement with the experimental results. (auth)

5776 NP-8168

Iowa State Univ. of Science and Technology, Ames.

CHARACTERISTICS OF A SUBCRITICAL ASSEMBLY EVALUATED BY NEUTRON WAVES (thesis). Frank Peter Mertes. 1959. 56p.

A new and more effective method of studying the phase angle and amplitude of the neutron waves in a subcritical assembly by a completely analytical method, with no dependence upon visual interpretation of graphs, was developed. The phase and amplitude of the neutron wave was determined as a function of vertical position in the assembly for two frequencies of oscillation. Phase and amplitude determinations were also made along a horizontal plane in the assembly. (W.D.M.)

5777 Y-1273

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

NUCLEAR SAFETY ANALYSES OF A TYPICAL PRODUCTION LINE FOR HIGH-FIRED UO_2 AT ≤ 4.5% U^{235} ISOTOPIC COMPOSITION. W. T. Mee, T. J. Cagle, and J. W. Wachter. Sept. 28, 1959. 69p. Contract W-7405-eng-26. OTS.

A compilation of nuclear safety analyses that exemplify those currently in use in the Y-12 Plant, along with a description of the form used, is presented. This form has been specially designed to facilitate nuclear safety analysis by the double contingency method described in Y-A2-261. The analyses illustrate the way in which approval might be given to a typical process flow for production of high-fired UO_2 from UF_6 material at ≤ 4.5% U^{235} isotopic composition. (auth)

5778

SOME ASPECTS OF THE SPHERICAL HARMONICS METHOD FOR NEUTRON-TRANSPORT PROBLEMS IN CYLINDRICAL GEOMETRY. Ladislav Trilifaj (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 390-5(1958). (In English)

A solution is first given of the Boltzmann differential equation for the transport of monoenergetic neutrons in a complete cylindrically symmetrical medium, which scatters neutrons isotropically, according to the method of spherical harmonics. The constants of integration, on the other hand, are then expressed by means of the terms of the spherical harmonics moments. A simpler procedure in obtaining the results of Davison (Can. J. Phys. 35, 576 (1957)) is shown. The given procedure, however, permits of a simple extension of the results to the case when the medium scatters neutrons anisotropically. (auth)

Elementary Particles

5779 AFOSR-TN-59-1072

Maryland. Univ., College Park.

HYPERFRAGMENT FORMATION FROM THE K^--DEUTERON INTERACTION IN FLIGHT. Physics Dept. Technical Report No. 154. T. B. Day, G. A. Snow, and J. Sucher. 1959. 9p. Contracts AT(40-1)-2504 and AF49(638)-24. OTS.

It was recently reported at the Kiev Conference that in the reaction $K^- + d \rightarrow \Sigma^- + n + \pi^+$, where the K^- is at rest, no sure examples of a (Σ^-,n) hyperfragment were found. On the other hand, one example of a (Σ^-,n) hyperfragment was reported as occurring in emulsion. If these results are strictly used, and it is assumed that the hyperfragment exists, but its formation in D is forbidden, then much information about the K^- meson and the hyperfragment is obtained. The percentage of the (K^-,d) reactions of the type which results in a bound (Σ^-,n) system is estimated. (W.D.M.)

5780 AFOSR-TN-59-1217

California. Univ., Berkeley.

ELECTROMAGNETIC STRUCTURE OF THE NUCLEON. Adam M. Bincer. [1959]. 35p. Contract AF49(638)-327.

Dispersion relations are proved for the electromagnetic and mesonic nucleon vertex functions considered as a function of the nucleon mass. The results are used to express the isotopic scalar and the isotopic vector electromagnetic form factors of the nucleon in terms of pion electroproduction (or photoproduction) and pion-nucleon scattering amplitudes in the $J = \frac{1}{2}$, $T = \frac{1}{2}$ state. (auth)

5781 NP-8201

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.

PION PRODUCTION IN p-d COLLISIONS AND INTRANUCLEAR MOTION OF NUCLEONS. Yu. D. Prokoshkin. 1959. 16p.

It is shown that the energy dependence of the reaction cross sections for pion production in nucleon-deuteron collisions and the energy spectra of pions may be calculated rather accurately on the basis of the data on free nucleon-nucleon collisions. In the considered energy

region from the threshold for meson production to ≈ 700 Mev the influence of the nucleon binding in a deuteron is essentially the change of the magnitudes of the cross sections due to the intranuclear motion of nucleons. There was found an effective momentum distribution of nucleons in a deuteron. (auth)

5782 NP-8229

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas and Brazil. Universidade, Rio de Janeiro. Faculdade Nacional de Filosofia.

DECAY OF $\Lambda_0 \rightarrow n + \gamma$ THROUGH NON LOCAL FERMI INTERACTIONS DUE TO VECTOR MESONS. J. L. Acioli. 1959. 12p. (Notas de Física Vol. V, No. 13).

The decay of $\Lambda^0 \rightarrow n + \gamma$ through non-local Fermi interactions due to vector mesons is calculated. It is found that the branching ratio of $\Lambda^0 \rightarrow n + \gamma$ with respect to experimental pionic decay mode $\Lambda^0 \rightarrow n + \pi^0$ can be of the order 5×10^{-4}. (auth)

5783 NP-8232

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas. and Princeton Univ., N. J. Palmer Physical Lab.

THE FORM FACTORS IN $K_{\mu 3}$ AND K_{e3} DECAY. S. W. Mac Dowell. 1959. 12p. (Notas de Física Vol. V, No. 11).

An investigation of the form factors in $K_{\mu 3}$ and K_{e3} decay amplitudes, on the assumption of local production of the fermion pair, is carried out by means of dispersion relations techniques. The approximation is made of taking explicit account of $K\pi$-scattering in the unitarity condition and all the other contributions are incorporated into a single arbitrary parameter. The validity of this approximation is discussed. The results are expressed in terms of S and P phase shifts for $K\pi$-scattering. (auth)

5784

COLLISION TERM IN THE BOLTZMANN TRANSPORT EQUATION. Edward A. Desloge and Steven W. Matthysse (Yale Univ., New Haven). Am. J. Phys. 28, 1-11(1960) Jan.

The scattering probability $W(v,v')$, associated with particles of mass m interacting by means of hard elastic collisions with moving scatterers of mass M, is obtained in terms of the corresponding scattering probability associated with scattering from rigid elastic scatterers. The collision term in the Boltzmann transport equation can then be written in a form which is convenient for handling both equilibrium and transport phenomena. The conditions of equilibrium are discussed. The approximate collision term for a distribution function of the form $f(v) = f_0(v) + v_x g(v)$ is derived, and the results applied to the problem of the conductivity to microwaves of a slightly ionized gas. (auth)

5785

CLASSICAL INTERACTION OF AN ELECTRIC CHARGE WITH A MAGNETIC MONOPOLE. I. Richard Lapidus and Jerry L. Pietenpol (Columbia Univ., New York). Am. J. Phys. 28, 17-18(1960) Jan.

The motion of a charged particle in the field of a magnetic monopole is calculated classically. The differential scattering cross section is obtained, and it is seen that in the limit of small interaction strength the cross section resembles the Rutherford cross section. A simple relativistic correction is discussed. (auth)

5786

MATRIX FORM OF THE EQUATIONS OF PROPAGATION IN AN ANISOTROPIC MEDIUM WITH A CONSTANT MAGNETIC FIELD. P. Szulkin. Bull. acad. polon. sci., Sér. sci. tech. 7, 581-7(1959). (In English)

5787

SPECTRAL DISTRIBUTION OF BREMSSTRAHLUNG FROM AN IONIZED GAS. Mahendra Singh Sodha (Illinois Inst. of Tech., Chicago). Can. J. Phys. 37, 1380-3(1959) Dec.

Using Heitler's and Sommerfeld's cross section the spectral distributions of bremsstrahlung from an ionized gas was calculated, neglecting self-absorption and stimulated emission. These results can be used to calculate the spectral distribution of bremsstrahlung from a mass of ionized gas, considering self-absorption and stimulated emission by utilizing the expression obtained by Allen and Hindmarsh. (auth)

5788

MULTILAYER PROBLEMS IN THE MULTIGROUP SPHERICAL HARMONICS METHOD. B. Davison (Univ. of Toronto and Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 37, 1482-98(1959) Dec.

In applying the spherical harmonics method to multilayer neutron transport problems it is necessary to invert certain matrices. In the case of one-group theory for the problems with plane, spherical, or cylindrical symmetry, these inverse matrices can easily be written down explicitly, so that there is no need for numerical matrix inversion. This result is extended to the case of multigroup theory. (auth)

5789

DRIFT MOBILITY OF ELECTRONS IN ATOMIC HYDROGEN. Mahendra Singh Sodha and Yatendra Pal Varshni (Illinois Inst. of Tech., Chicago). Can. J. Phys. 37, 1552-5 (1959) Dec.

Expressions were developed which describe the drift mobility of electrons in atomic hydrogen. The zero order partial cross section is calculated for Y = 0.1 to 2.0 and the results compared to those obtained by Erginsoy's approximation. (C.J.G.)

5790

ENERGY SPECTRUM OF α PARTICLES EMITTED FROM SOURCES OF DIFFERENT THICKNESSES. Ivo Chudáček (Charles Univ., Prague). Czechoslov. J. Phys. 8, 396-403(1958). (In English)

The shape of the energy distribution of all α particles emitted by sources of different thicknesses was investigated. The energy distribution N(E)dE found can be expressed by a semi-empirical formula, which on the whole agrees with experiment. The source of α particles was uranium oxide U_3O_8. The energy distribution was measured with AGFA K2 nuclear emulsions 200 μ thick. Altogether 3,602 trajectories of α particles in the nuclear emulsions of five plates were measured. (auth)

5791

TRANSITION RADIATION OF A CHARGE AT INCLINED ANGLE OF INCIDENCE. N. A. Korkhmazyan (Erivan State Univ., Armenian SSR). Izvest. Akad. Nauk Armyan. S.S.R., Ser. Fiz.-Mat. Nauk 11, 87-95(1958). (In Russian)

A solution is derived for a generalized case of radiation from a charged particle passing at an arbitrary angle incident to the plane boundary dividing two arbitrary media. The problem is solved by the visual charge method, permitting a fast analysis of the problem. (R.V.J.)

5792

TIME-DEPENDENT ELECTRON FLOW. M. C. Pease (Sylvania Electric Products Inc., Mountain View, Calif.). J. Appl. Phys. 31, 70-76(1960) Jan.

The conditions of self-consistency for electron flow through arbitrary static or time-varying electric and magnetic fields are established assuming (a) nonrelativistic

flow, (b) single streaming—i. e., the velocity has a single value and direction at every point, and (c) the electrons originate on a cathode not threaded by magnetic lines of force. In the case where the magnetic field is constant and uniform, a single-vector differential equation can be written which determines all possible solutions. From this equation certain time-variant solutions are developed. These are fully self-consistent—that is, large signal—solutions which exhibit some of the nonlinear behavior that would be expected of such solutions. Probably the most interesting of these solutions—since it offers an explanation of an observed phenomenon that does fit previous theory—is a radial oscillation of the cloud in a filamentary cathode smooth bore magnetron at $\omega/\sqrt{2}$. The possible application of the other solutions to anomalous behavior in various magnetron type devices is also discussed. (auth)

5793

SEARCH FOR THE "ANOMALOUS" SCATTERING OF Mu-MESONS. (ON THE APPARATUS USING A DELAYED COINCIDENCE METHOD). Takashi Kitamura (Osaka City Univ.). J. Phys. Soc. Japan 14, 1654-63(1959) Dec.

A critical discussion is presented on experimental results and theories reported by other workers on μ-meson anomalous scattering. It is concluded that the apparatus used to obtain previously reported scattering results showed uncertainties in determining the identity and momenta of μ-mesons. An experimental apparatus is described which utilizes a Wilson cloud chamber, G. M. counters, and a delayed coincidence method to separate μ-mesons from other particles. The possibility of triggering this arrangement with particles other than μ-mesons was found to be quite negligible. (C.J.G.)

5794

ON A POSSIBLE TEST OF QUANTUM ELECTRODYNAMICS IN ELECTRON SCATTERING. G. V. Avakov and K. A. Ter-Martirosyan (Inst. of Theoretical and Experimental Physics, Moscow). Nuclear Phys. 13, 685-94(1959) Nov. (3).

It is shown that a violation of quantum electrodynamics of the type corresponding to an effective nonlocal structure of an electron may be found through a study of the elastic scattering of electrons on α-particles (with a very small improvement in accuracy of measurements as compared with the level attained so far). Because of the absence of spin and magnetic moment elastic scattering on α-particles is generally a very convenient process for detecting any kind of violation of the theory in the region of not very small distances (of the order of 10^{-13} cm to 10^{-14} cm). Unlike the case of α-particles, the scattering of electrons on nucleons offers in principle no possibility of detecting violations of the theory of the type under consideration (if one excludes such complex experiments as measuring changes in the polarization of electrons in scattering or the scattering of polarized electrons on polarized nucleons). (auth)

5795

SPACE AND ENERGY SEPARABILITY OF THERMAL FLUX IN A DIFFUSING MEDIUM. E. M. Gelbard and J. J. Pearson (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 6, 453-5(1959) Nov.

The steady-state diffusion of neutrons from a thermal plane source in an infinite medium is discussed. Source neutrons were assumed to be slowed to the thermal range through collisions with free protons in thermal motion. The flux near the thermal cut point is attenuated rapidly as the neutrons diffuse away from the source. This phenomenon appears to determine the width of the transient region, as long as a slowing-down force is assumed. If the source spectrum was Maxwellian, the transient behavior would be quite different and the transient region would probably be smaller. (B.O.G.)

5796

AGE IN D_2O–H_2O MIXTURES. W. H. Arnold, Jr. (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 6, 456-7(1959) Nov.

The age to indium resonance (1.4 ev) of fission neutrons in various mixtures of D_2O and H_2O was measured. These data were compared to calculated values obtained using the MUFT 4 code, which was modified to include the term $\partial\lambda/\partial\mu$ in the Grueling-Goertzel-Amster approximation. The two sets of data were in excellent agreement. (B.O.G.)

5797

THE INTERACTION OF K^--MESONS WITH PHOTOGRAPHIC EMULSION NUCLEI. PART II. THE EMISSION OF HYPERONS FROM K^--INTERACTIONS AT REST. (K^--COLLABORATION). B. Bhowmik, D. Evans, D. Falla, F. Hassan, A. A. Kamal, K. K. Nagpaul, and D. J. J. Prowse (Univ. of Bristol, Eng.); M. René (Université Libre, Brussels); G. Alexander, R. H. W. Johnston, and C. O'Ceallaigh (Inst. for Advanced Studies, Dublin); D. Keefe (University College, Dublin); E. H. S. Burhop, D. H. Davis, R. C. Kumar, W. B. Lasich, M. A. Shaukat, and F. R. Stannard (University College, London); M. Bacchella, A. Bonetti, C. Dilworth, G. Occhialini, and L. Scarsi (Università, Milan and Istituto Nazionale di Fisica Nucleare, Milan); and M. Grilli, L. Guerriero, L. von Lindern, M. Merlin, and A. Salandin (Università, Padua and Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 14, 315-64(1959) Oct. 16. (In English)

The emission of Σ-hyperons from 3037 K^- capture stars at rest in nuclear emulsion was studied. The identification of the hyperons is discussed. Charged Σ-hyperons were emitted from (17.6 ± 1.0)% of all K^--stars while (9.6 ± 0.6)% of them lead to the emission of both Σ-hyperons and π-mesons. The Σ^-/Σ^+ ratio for all stars is 0.86 ± 0.12, while for stars in which a π-meson is also emitted the ratio is 0.45 ± 0.10. The difference between this latter value and the markedly different value (2.0) obtained for K^--interactions at rest in a hydrogen bubble chamber is attributed to the Fermi motion of nucleons in the nucleus, and a dependence of the relative K^- transition amplitudes on the energy of relative motion of the K^--meson and nucleon. The branching ratio, R, of the number of Σ^+ decays to π^+ and proton respectively is 1.23 ± 0.27. The stable prong distribution of the stars in which a hyperon is emitted, as well as the energy distribution of the Σ-hyperons at emission was studied. About 16% of all identified charged Σ-hyperons had an emission energy above 60 Mev, and had to be attributed to multi-nucleon interactions of the K^--meson. It is estimated that the proportion of all multi-nucleon primary capture processes may be as high as 30 to 40%. From the fraction of Σ^+ emitting stars which also emit a π^--meson it is concluded that only about 10% of the π^--mesons fail to escape from the nucleus in which capture occurs. This could be understood if K^--capture occurs predominantly in the peripheral region of the nucleus. From a similar study of Σ^- emitting stars it is found however that the proportion of $\pi^\pm$ or π^0-mesons, or both, that are absorbed in the nucleus is much higher. Estimates are made of the mean free path in nuclear matter of Σ-hyperons and π^0-mesons. Most of the one-nucleon interactions leading to Σ-hyperon production take place with protons and the transition amplitudes corresponding to the T = 1 state of isotopic spin is smaller than the T = 0 transition amplitude. (auth)

5798

THE PROTON-NEUTRON MASS-DIFFERENCE ACCORDING TO MESON-THEORY. L. O'Raifeartaigh, B. Średniawa, and Ch. Terreaux (Universität, Zürich). Nuovo cimento (10) 14, 376-96(1959) Oct. 16. (In English)

The proton-neutron mass difference is calculated assuming that it is due to a mixed mesic-electromagnetic self-energy. The self-energies of the proton and neutron are calculated in the e^2f^2 approximation on grounds of meson theory both for P-S and P-V coupling. To make these finite the form factor suggested by Arnous and Heitler is applied to all three (nucleon-meson, nucleon-photon, and meson-photon) interactions. It corresponds to a cut-off of the virtual momenta at K (of order M = nucleon mass), when the particle is at rest and is therefore a generalization of the extended source model. To carry through the otherwise extremely complicated calculation a further crude approximation is made, namely an expansion ~1/M. For both couplings the correct sign is obtained but in the P-S case the result is too small by a factor 100. In the P-V case the correct order of magnitude is obtained but the numerical value is still too small (by a factor of at least 5 or so) to overcompensate the purely electromagnetic self-energy of the proton. A comparison with the earlier work of Feynman and Speisman shows that the latter is not in agreement with the results of meson theory. (auth)

5799

ON THE EXISTENCE OF THE HYPERNUCLEUS $^6He_\Lambda$. L. H. Schick (Univ. of Colorado, Boulder). Nuovo cimento (10) 14, 426-34(1959) Oct. 16. (In English)

Hypernuclei were observed for all $2 < A \leq 9$ with the exception of A = 6. The lack of observation of both He^6_Λ and Li^6_Λ implies that the binding energies of these hypernuclei either are negative, or are positive but less than that of He^5_Λ so that if formed they decay immediately into He^5_Λ + nucleon, or are greater than that of He^5_Λ in which case their ultimate observation would be expected. The He^6_Λ hypernucleus was analyzed to determine in which of these three regions its binding energy lies. This analysis is carried out under the assumption that He^6_Λ is a bound system, Λ + (neutron + α). A variation calculation using phenomenological potentials yields a lower bound of (2.00 ± 0.60) Mev for the total binding energy of He^6_Λ. This indicates that both He^6_Λ and Li^6_Λ are unstable against decay into He^5_Λ + nucleon and are therefore not expected to be observed. (auth)

5800

CHARGE DISTRIBUTION OF THE NUCLEON. V. De Alfaro and E. Predazzi (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 14, 448-51(1959) Oct. 16.

Experimental data on the charge distribution in the nucleon are checked for fitness to the asymptotical behavior of the nucleon structure as described by Bosco and de Alfaro. Good fit was found for the proton form factor whereas very poor agreement was found for the neutron form factor. The experimental data were compared to that value of C_v obtained by continuation of $A_2(\nu,\Delta^2)$ and $B_2(\nu,\Delta^2)$ in the point $\nu = 0$ and $\Delta^2 = -4\mu^2$. Agreement was found to be very poor. (C.J.G.)

5801

ON POSITRON LIFETIME IN ANTHRACENE. C. Cottini, G. Fabri, E. Gatti, and E. Germagnoli (Centro Informazioni Studi Esperienze, Milan). Nuovo cimento (10) 14, 454-5(1959) Oct. 16. (In English)

The decay times of positrons were measured in anthracene in the range −200 to 295°C. The lifetime in solid anthracene was $(3.7 \pm 0.2) \times 10^{-10}$s. Above the melting point the value was 2.3×10^{-9}s. (C.J.G.)

5802

COULOMB SCATTERING IN A MAGNETIC FIELD. P. A. Sweet (Univ. of London Observatory). Phil. Mag. (8) 4, 1155-9(1959) Oct.

It is shown that the contributions of distant encounters to the velocity diffusion coefficients in Coulomb scattering are convergent when a magnetic field is present, and that no cut-off is required in the impact parameter. A cut-off is required in the coefficient which defines space diffusion across the field. In a plasma the diffusion coefficients are slightly reduced when the typical gyromagnetic radius of the particles is less than the Debye length. (auth)

5803

DOUBLE SCATTERING OF ELECTRONS WITH A DIPOLE MOMENT. M. H. Zaidi (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 116, 241-3(1959) Oct. 15.

The double scattering of electrons with a small intrinsic electric dipole moment is investigated theoretically for the case where magnetic and electric fields are present in the space between the two targets. It is shown by using density matrix techniques that the plane of polarization of the electron beam, after the first scattering, would be rotated by the magnetic and electric fields just as predicted by regarding the electrons as classical spinning tops with magnetic moments and classical electric dipoles precessing about the directions of the magnetic and electric fields, respectively. (auth)

5804

COLLISIONS OF ELECTRONS WITH HYDROGEN ATOMS. IV. EXCITATION OF LYMAN-ALPHA RADIATION NEAR THRESHOLD. Wade L. Fite, R. F. Stebbings, and R. T. Brackmann (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 116, 356-7(1959) Oct. 15.

By use of improved experimental techniques, the cross section for excitation of Lyman-alpha radiation in collisions between electrons and hydrogen atoms was remeasured It was determined that in the threshold region, the results reported previously were somewhat low. The remeasured energy dependence of the cross section near threshold was found to be as the square root of the excess energy. (auth)

5805

A NOTE ON THE SCATTERING OF ELECTRONS FROM ATOMIC HYDROGEN. A. Temkin (National Bureau of Standards, Washington, D. C.). Phys. Rev. 116, 358-63 (1959) Oct. 15.

The distortion of atomic hydrogen by a slowly moving electron at a large distance from the center of the atom is examined. The problem is the initial phase of a previously described method for the calculation of electron scattering which takes this distortion into account. The initial (static) problem is solved analytically and extended to include higher order effects of the interaction of the electron with the atomic cloud. The construction of a wave function to describe scattering starting from the solution of the static problem is clarified. This yields as an incidental result a new approximation of the second order perturbation energy associated with the above distortion. A short discussion of the present experimental results for this scattering process is included. (auth)

5806

ENERGY DETERMINATION FROM MULTIPLE MESON

PRODUCTION BY 6.3-Bev PROTONS IN NUCLEAR EMULSION. P. L. Jain and H. C. Glabe (Univ. of Buffalo). Phys. Rev. 116, 458-60(1959) Oct. 15.

864 stars produced by the 6.3-Bev proton beam of the Berkeley Bevatron were observed in nuclear emulsion. The average number of shower particles was 2.7 prongs per star. The energy of the primary particle was determined by three different methods: (a) the median angle method; (b) Castagnoli's method; (c) Cocconi's graphical method. It is found that the results of these three methods are in good agreement with each other and are high in each case by a factor of 2. (auth)

5807

GREEN'S FUNCTIONS FOR ELEMENTARY PARTICLES. Hiroshi Ezawa and Hiroomi Umezawa (Univ. of Tokyo). Phys. Rev. 116, 463-4(1959) Oct. 15.

Recently, Harris has raised an objection against work on the general structure of the Green's function for particles of arbitrary spin. Reasons are given here why his objection is not valid. (auth)

5808

$\pi^+ - p$ SCATTERING AND PHASE-SHIFT ANALYSIS AT 310 MEV. James H. Foote, Owen Chamberlain, Ernest H. Rogers, Herbert M. Steiner, Clyde Wiegand, and Tom Ypsilantis (Univ. of California, Berkeley). Phys. Rev. Letters 4, 30-3(1960) Jan. 1.

At the 184-inch synchrocyclotron in Berkeley, data were obtained on elastic $\pi^+ - p$ scattering at 310 Mev. Quantities measured were the differential cross section, the total cross section, and the polarization of the recoil protons as a function of center-of-mass angle. The data were analyzed in terms of S, P, and D waves and only one acceptable solution was obtained—the Fermi type phase shift. Errors on the small phase shift were reduced to less than 1°. (B.O.G.)

5809

POLARIZATION OF Λ^0 FROM PHOTOPRODUCTION IN HYDROGEN. B. D. McDaniel, P. Joos, D. McLeod, S. Richert, and D. Zipoy (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Letters 4, 33-5(1960) Jan. 1.

The reaction $\gamma + p \rightarrow K^+ + \Lambda^0$ was analyzed for evidence of Λ^0 polarization with respect to the production plane. The polarization is analyzed by means of the asymmetric decay, $\Lambda^0 \rightarrow p + \pi^-$. From the measurements, calculations were made which gave a maximum polarization equal to 0.53 at 32°. (B.O.G.)

5810

ELASTIC SCATTERING OF K^- MESONS BY NUCLEI. P. B. Jones (Clarendon Lab., Oxford). Phys. Rev. Letters 4, 35-6(1960) Jan. 1.

Small-angle elastic scattering of K^- at 144 to 106 Mev by nuclei was investigated. The experimental cross sections were compared to those obtained from the solution of the Klein-Gordon equation, in which the $K^- - N$ optical model potential, $V(\frac{r}{\gamma}) = (U - iW)f(\frac{r}{\gamma})$, is taken to be the fourth component of a relativistic 4-vector. The most probable value of U was found to be -30 Mev, based on energy loss. The value of U at lower K^- energies would be useful, but at 70 Mev the elastic scattering is almost insensitive to U. (B.O.G.)

5811

ON THE PAULI GROUP. D. Lurié (Université Libre, Brussels). Physica 25, 1139-41(1959) Nov. (In English)

An eight-dimensional generalization of Wouthuysen's six-dimensional scheme for fermions is seen to result if use is made of the three-parameter Pauli group. (auth)

5812

THE SCATTERING OF ALPHA PARTICLES BY HELIUM. A. C. Butcher (Univ. of Glasgow) and J. M. McNamee (University College, London). Proc. Phys. Soc. (London) 74, 529-39(1959) Nov. 1.

Nuclear phase shifts are calculated for the scattering of two alpha particles, using the method of the resonating group structure, and assuming central Gaussian internucleonic potentials and Gaussian wave functions. It is found that a mixture of two-thirds Serber and one-third MHWB exchange force gives good agreement with the experimentally observed phase shifts. (auth)

5813

THE EXPERIMENTAL DETERMINATION OF THE RANGE-ENERGY RELATIONS FOR ALPHA PARTICLES IN WATER AND WATER VAPOUR, AND THE STOPPING POWER OF WATER AND WATER VAPOUR FOR ALPHA PARTICLES AT ENERGIES BELOW 8.78 MEV. R. B. J. Palmer and H. A. B. Simons (Royal Free Hospital School of Medicine, London). Proc. Phys. Soc. (London) 74, 585-98(1959) Nov. 1.

A method for measuring the residual energy of alpha particles which have traversed paths of various lengths in water is described, and also a method for determining total alpha-particle range in water, the results being used to deduce a range–energy relation for alpha particles of energy up to 8.78 Mev in liquid water. A method is described for measuring the residual energy of alpha particles which have passed through air and through water vapor, and by means of a scintillation detector the complete alpha-particle range in air and in water vapor is established. From these results range–energy relations are deduced for alpha particles in air and in water vapor The differential and integral stopping power of water and water vapor at various energies is calculated and the results are discussed. (auth)

5814

PROTON-PROTON ELASTIC INTERACTIONS AT 930 MEV. J. D. Dowell, W. R. Frisken, G. Martelli, and B. Musgrave (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 74, 625-31(1959) Nov. 1.

The elastic scattering of 930 Mev protons by protons present in a propane bubble chamber is investigated. The method of isolating elastic p-p events from backgound contaminations is discussed. An estimate is made of the scanning efficiency and the elastic cross section is found, from track length measurements, to be 21.6 ± 2.5 mb, in good agreement with the values obtained by other authors. The angular distribution of the scattered particles is also given and compared with the predictions of two high energy models. (auth)

5815

NUCLEON POLARIZATION FROM CHARGE-EXCHANGE REACTIONS IN DEUTERIUM. R. J. N. Phillips (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Phys. Soc. (London) 74, 652-5(1959) Nov. 1.

The polarization of fast neutrons emerging in the forward direction from high-energy d(p,n) reactions was considered. The impulse approximation was used in relation to the nucleon-nucleon phase shifts. Equations for the neutron polarization and the free p-n polarization were derived and compared. (B.O.G.)

5816

THE SCATTERING OF FAST CHARGED PARTICLES. VI. THE MULTIPLE SCATTERING OF 10 MEV ELECTRONS AND POSITRONS IN NUCLEAR EMULSIONS.

K. Phillips and C. Ambasankaran (Metropolitan-Vickers Electrical Co., Ltd., Manchester, Eng.). Proc. Phys. Soc. (London) 74, 655-9(1959) Nov. 1.

Nuclear emulsions were used to study the multiple scattering of fast particles. The resulting mean energies from the electron and positron distributions are compared to calculated energies obtained from the Moliere theory. Good agreement was obtained when the experimental and calculated values were plotted. (B.O.G.)

5817

SPACE-CHARGE SLOWING-DOWN OF ELECTRON AVALANCHES. K. J. Schmidt-Tiedemann (Universität, Hamburg). Z. Naturforsch. 14a, 989-94(1959) Nov. (In German)

The electric field generated by the positive and negative space charge of a single electron avalanche moving in a homogeneous electric field is calculated. Treating the interaction of the avalanche with its own space charge field as a first order perturbation, a growth formula is obtained which differs markedly from the common Townsend formula. The theoretical results fit well with experimental data on avalanche statistics reported in the literature. (auth)

5818

CARRIER INCREASE OF AN AVALANCHE WITH SINGLE SPACE CHARGE. Karl Richter (Universität, Hamburg). Z. Physik 157, No. 1, 130-33(1959). (In German)

From oscillograms of avalanches of high amplification (ether, p = 370 Torr, d = 0.3 cm, E/p = 77) one can deduce that the number of carriers (n) increases less than $e^{\alpha x}$, if n overpasses 10^6. It is the space charge field of the positive ions which reduces the ionisation effect of electrons. (auth)

5819

ON MEASUREMENT OF THE MOMENTA OF FAST PARTICLES AND INVESTIGATION OF NUCLEAR INTERACTIONS IN THE 10^{10}–10^{12} ev ENERGY RANGE. M. I. Daĭon and V. Kh. Volynskii (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 906-9(1959) Oct. (In Russian)

A new method for direct measurement of the momenta of charged particles in a magnetic field in the 10^{10} to 10^{12} ev energy range is proposed which is based on simultaneous application of spark counters and nuclear emulsions. The possibility of application of the method for measurement of momenta spectra and investigation of nuclear interactions between protons and matter is considered. (auth)

5820

ELASTIC SCATTERING OF 8.5 Bev PROTONS ON PROTONS. V. B. Lyubimov, P. K. Markov, E. N. Tsyganov, Chen P'u-ying, and M. G. Shafranova. Zhur. Eksptl'. i Teoret. Fiz. 37, 910-16(1959) Oct. (In Russian)

Photographic emulsions were used to study p-p-scattering at an energy of 8.5 Bev. The irradiation geometry was such that the incident protons were perpendicular to the plane of the photographic emulsion. Sixty-six events of elastic scattering were found. Scattering on quasi-free protons and other background effects comprised about 2%. The elastic scattering cross section was (8.4 ± 1.1) mb. The differential cross section down to 2.5° in the c.m.s. was derived. Near 0° it is larger than would be expected on basis of the purely absorbing proton model. (auth)

5821

SCATTERING OF A PHOTON ON A NUCLEON IN THE ONE-MESON APPROXIMATION. E. D. Zhizhin. Zhur. Eksptl'. i Teoret. Fiz. 37, 994-9(1959) Oct. (In Russian)

Scattering of a photon on a nucleon proceeding via strong interaction is treated with account of exchange of a single π meson. The scattering matrix is computed for angular momentum values up to $J = 7/2$. The angular distributions for reactions involving polarized particles are presented. (auth)

5822

EFFECT OF MULTIPLE SCATTERING ON PAIR PRODUCTION BY HIGH ENERGY PARTICLES IN A MEDIUM. F. F. Ternovskii (Moscow State Univ.) Zhur. Eksptl'. i Teoret. Fiz. 37, 1010-16(1959) Oct. (In Russian)

The effect of multiple scattering on pair production by a fast charged particle passing through a medium is considered. The calculations are carried out by a method previously developed by Migdal. (auth)

5823

CALCULATION OF PHASE INTEGRALS IN THE COVARIANT FORMULATION OF THE THEORY OF MULTIPLE PRODUCTION OF PARTICLES. L. G. Yakovlev (Uzbek State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1041-5(1959) Oct. (In Russian)

A method is proposed for exact calculation of integrals over momentum space in the covariant statistical theory of multiple particle production. The method is applicable to other modifications of the theory although the calculations become more complicated. Approximate and exact calculations are performed. (auth)

5824

ON TWO TYPES OF NEUTRINOS, LEPTON ISOTOPIC SPIN, AND UNIVERSAL FOUR-FERMION INTERACTION. E. M. Lipmanov (Stalingrad State Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1054-7(1959) Oct. (In Russian)

It is suggested that two types of neutrinos exist in nature, ν_1 and ν_2 which, although having identical longitudinal polarizations, may have different lepton charges and which form, together with the electron and μ meson, two isotopic lepton doublets ($\nu_1 e$) and ($\nu_2 \mu$). The electron and μ-meson lepton charges are also opposite. The laws of conservation of isotopic spin and lepton charge and chirality uniquely specify the nature of μ decay and yield the selection rules which exclude various unobservable reactions involving leptons. (auth)

5825

EFFECT OF VISCOSITY IN MULTIPLE PRODUCTION ON THE ENERGY DISTRIBUTION OF SECONDARY PARTICLES. A. A. Emel'yanov and D. W. Chernavskii (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1058-61(1959) Oct. (In Russian)

The effect of viscosity on processes occurring in a simple wave is considered in the hydrodynamical theory of multiple production of particles. It is found that at sufficiently high energies the effect of viscosity on the energy distribution of the fastest particles may be significant. (auth)

5826

ON ELECTROMAGNETIC CORRECTIONS IN μ–e DECAY. V. P. Kuznetsov (Moscow Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1102-5(1959) Oct. (In Russian)

Electromagnetic corrections to the angular distribution of electrons were obtained for the V–A theory of μ–e decay. (auth)

5827

ON THE THEORY OF RELATIVISTIC TRANSFORMATIONS OF THE WAVE FUNCTIONS AND THE DENSITY

MATRIX OF PARTICLES WITH SPIN. V. S. Popov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1116-26(1959) Oct. (In Russian)

An expansion is obtained of the wave functions of a particle with spin s and of a system of two particles with spin s_1 and s_2 over the irreducible representations of the homogeneous Lorentz-group; this allows one to give a relativistically invariant classification of the states. For an invariant description of the polarization of free particles an expansion is found of the density matrix over the irreducible representations of the Lorentz group. (auth)

5828

LEAST ERROR IN ASYMMETRY EXPERIMENTS. N. P. Klepikov (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1139-42(1959) Oct. (In Russian)

Experiments carried out with elementary particles in order to confirm or refute the conservation of spatial parity or particle spin are often confirmed by certain asymmetries in particle distributions. An attempt is made to determine the probability of error in the presence or absence of such asymmetry. (R.V.J.)

5829

ON SOME PECULIARITIES OF $E > 2 \times 10^{12}$ ev PARTICLE INTERACTIONS WITH LIGHT NUCLEI. N. L. Grigorov and V. Ya. Shestoperov (Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1147-9 (1959) Oct. (In Russian)

Experimental data are presented showing the existence of interactions resulting in nearly complete primary particle energy loss in the production of π^0 mesons. An analysis is made of the probabilities of such processes. (R.V.J.)

5830

PHOTOPRODUCTION OF π^0 MESONS IN CARBON AT THE THRESHOLD. R. G. Vasil'kov, B. B. Govorkov, and V. I. Gol'danskiĭ (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1149-51 (1959) Oct. (In Russian)

The process of elastic π^0 photoproduction on carbon was analyzed by correlating the total cross section ratio of π^0 photoproduction on carbon and hydrogen at primary photon energies of 160, 180, and 200 Mev. The energy dependence curves of γ yields from π^0 decay were measured at three angles. The decay photon yields were determined with an accuracy of 1 to 2%. A predominant elastic photoproduction was observed at photon energies of 160 to 200 Mev, while at higher energies indications of inelastic π^0 photoproduction appeared which were expressed by small deflections between the experimental and the theoretical ratio σ_t^C/σ_t^H. Similar measurements of π^0 photoproductions on beryllium showed a great similarity in the total cross section energy dependence. (R.V.J.)

5831

MEASUREMENTS OF THE LONGITUDINAL POLARIZATION OF β ELECTRONS. L. A. Mikaelyan and P. E. Spivak. Zhur. Eksptl'. i Teoret. Fiz. 37, 1168-70(1959) Oct. (In Russian)

Longitudinal polarization is converted into transverse during electron passage through reciprocally perpendicular magnetic and electric fields. Upon leaving the active field region, the electrons pass through a filter system and enter into a thin gold foil diffuser. Geiger counters are used for recording electrons scattered at 120°. The magnitude of the left-right scattering asymmetry was measured for determining polarization. Relative comparisons were made of the electron polarization from P^{32}, In^{114}, Lu^{177}, Sm^{153}, and Ho^{166}, and the absolute polarization value for Sm^{153} was found. (R.V.J.)

Nuclear Properties and Reactions

5832 AECU-4533

Wisconsin. Univ., Madison.

A FAST HYPERFRAGMENT PRODUCED BY A HEAVY PRIMARY COSMIC RAY. U. Camerini, W. F. Fry, T. Groves, and H. Huzita. [1959]. 3p. Contract AT(11-1)-64. OTS.

A stack of 6″ × 12″ G-5 600 microns Ilford emulsions, which was flown over Texas for 8 hours above 104,000 ft, was scanned for entering heavy primaries. These were followed until they either interacted or left the stack. One event was found which was interpreted as a decay in flight of a $_{\Lambda}H^4$. A description of this event is given. (W.D.M.)

5833 AECU-4565

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

THE LOW ENERGY PHOTODISINTEGRATION OF ^3H AND ^3He AND NEUTRON-DEUTERON SCATTERING. L. M. Delves. [1959]. 18p. Contract AT(30-1)-2098. OTS.

The cross sections for electric dipole photodisintegration of H^3 and He^3 at low energies are expressed in terms of the effective range parameters of the doublet n-d scattering matrix. Agreement with the experimental results is possible for either set of n-d scattering lengths. (auth)

5834 DASA-525

Defense Atomic Support Agency, Washington, D. C.

CALCULATED ABUNDANCES AND ACTIVITIES OF THE PRODUCTS OF HIGH ENERGY NEUTRON FISSION OF URANIUM-238. P. J. Dolan. May 7, 1959. 123p.

Calculated abundances and activities of each fission product radionuclide as well as the activity of the total fission product mixture at various times after simultaneous high-energy neutron fission of 10,000 atoms of U^{238} are presented in tabular form. The percentage contribution to the total activity of each fission product radionuclide and the disintegration rate of the total fission product mixture are presented graphically. (auth)

5835 DASA-526

Defense Atomic Support Agency, Washington, D. C.

GAMMA SPECTRA OF URANIUM-238 FISSION PRODUCTS AT VARIOUS TIMES AFTER FISSION. P. J. Dolan. May 7, 1959. 58p.

Calculated gamma spectra produced by 14-Mev fission of U^{238} are tabulated for various times after fission. Similar tabulations are given omitting certain volatiles and portions of their daughter products. The tabulated data are also presented in graphical form. (auth)

5836 NP-8192

Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab.

AN ANALYSIS (d,t) PICK-UP REACTIONS (thesis). Amélia Império Hamburger. FINITE RANGE CORRECTION IN DISTORTED WAVES CALCULATIONS. Norman Austern. Technical Report No. II [on] PRECISION SCATTERING OF NUCLEAR PARTICLES. Nov. 1959. 52p. Contract Nonr-624(10).

A comparison is made between (p,d) [or (d,p)] and (d,t) pick-up reactions involving transitions between the same nuclear levels. Cases are studied for nuclei from A = 6 to 25 (also A = 117), for orbital angular momentum transfer l = 0, 1, and 2, and for incident energies of the order of 15 Mev. It is found that if the differential cross sections of

the corresponding (d,p) and (d,t) reactions are plotted as functions of momentum transfer the curves differ by a factor independent of angle. This property holds primarily in the region of the first peak of the angular distribution. Toward larger angles the curves differ in shape. Because of the proportionality between the curves in the forward direction, it is possible to obtain an expression for extracting the stripping reduced width of (d,t) reactions. This reduced width corresponds to the reduced width of the same transition when studied by a (d,p) process. No emphasis is placed on the interpretation of the results in terms of the structure of the triton. An attempt is made to determine the triton momentum transform directly from an analysis of the d + d → p + t experiments, considering these as stripping reactions. It was not possible to apply the curves thus obtained to the (d,t) reactions in the heavier nuclei. An experiment was performed, to extend the information about transitions with l = 0. The angular distribution of the reaction $F^{19}(d,t)F^{18}$ g.s. was measured with 14.8 Mev deuterons. (auth)

5837 NP-8221

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas. GAMMA RAYS IN THE DECAY OF ^{141}Nd. E. W. Cybulska and L. Marquez. 1959. 6p. (Notas de Física Vol. V, No. 12).

The gamma rays in the decay of Nd^{141} were studied with scintillation spectrometers and coincidences. Seven lines were established with energies of 38, 145, 420, 510, 880, 1150, and 1300 kev. Their relative intensities are 100, 1.7, 0.6, 9.7, 1.2, 2.3, and 1.5, respectively. The line of 38 kev is due to K-capture in Nd^{141} and the line of 510 kev is due to annihilation radiation from the positrons of Nd^{141}. The remaining five lines are due to levels in Pr^{141}. A decay scheme is proposed. (auth)

5838 TNCC/UK-33

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

PILE OSCILLATOR MEASUREMENTS OF RESONANCE ABSORPTION INTEGRALS. R. B. Tattersall, H. Rose, S. K. Pattenden, and D. Jowitt. Dec. 1958. 18p. (NRDC-112).

Measurements of the resonance absorption integral cross sections of 25 elements are reported. The data were obtained by means of the Dimple pile oscillator, and the materials concerned were measured in a pure thermal spectrum and in one with an appreciable epithermal component, the difference of the effective cross sections found in the two cases leading directly to the resonance integrals. Experiments were also made to determine the effects of self-screening in a number of the samples measured. The measured cross-sections are compared with estimates of the resonance integrals which are deduced from resonance parameter data. (auth)

5839 AEC-tr-3934

Th^{232} FISSION BY THERMAL NEUTRONS. E. I. Korneev (Korneyev), V. S. Skobkin, and G. N. Flerov. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Eksptl'. i Teoret. Fiz. 37, 41-5(1959). 7p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20558.

5840 AEC-tr-3944

MEAN NUMBER OF PROMPT FISSION NEUTRONS IN U^{238} AND Th^{232}. B. D. Kuz'minov. Translated by Lydia Venters (Argonne National Lab.) from a Russian Report Presented by the Mission of Scientists during their Visit to Argonne National Lab. in November 1959. 9p. JCL or LC.

The dependence of the mean number of prompt fission neutrons on the fission neutron energy was studied. The measurements of $\bar{\nu}$ for U^{238} and Th^{232} at neutron energies E_n = 2.3, 3.75, and 15.7 Mev were carried out. The results obtained indicate an approximately linear increase in $\bar{\nu}$, when the energy of neutrons which induced the fission is increased. For U^{238} $d\bar{\nu}/dE_{n-f}$ = (0.144 ± 0.008)/Mev, for Th^{232} $d\bar{\nu}/dE_n$ = (0.15 ± 0.01)/Mev. (auth)

5841 CEA-tr-A-599

DURÉE DE VIE ET SCHÉMA DE DÉSINTÉGRATION ^{235}U. (Lifetime and Decay Scheme of U^{235}). E. Wurger, K. P. Meyer, and P. Huber. Translated into French from Helv. Phys. Acta 30, 157-82(1957). 39p.

An exact value of the U^{235} decay constant is needed for accurate age determinations of U ores. A method is described for obtaining this value which involves a $\gamma-\alpha$ coincidence study of the U^{235} decay scheme and a measurement of the ratio of α activity of U^{235} and U^{238} to U^{234} in natural U. The apparatus and technique for these studies are described. The average value found for the ratio of intensities was 0.04776 ± 0.00094. The period calculated from this is 6.84 ± 0.15 × 10^8 yr. (T.R.H.)

5842 XDC-59-12-34

MECHANISM OF (n, 2n) REACTION OF Be-9 AND DIFFERENTIAL CROSS SECTION FOR ϕ = 90° at NEUTRON ENERGY OF 3.7 MEV. P. Huber and R. Wagner. Translated by J. W. Zwick (General Electric Co. Aircraft Nuclear Propulsion Dept.) from Helv. Phys. Acta 30, 257 (1957). 4p. JCL.

A small Be^9 cylinder was irradiated with neutrons from the d-d reaction, and the spectrum of neutrons emitted at an angle of ϕ = 90° was determined with an Ilford C-2 Plate. The uncorrected neutron spectrum plus the background and the background spectrum are shown. The difference spectrum corrected for the (n,p) cross sections is shown. The differential cross section for the ϕ = 90° at 3.7 Mev was determined from the line intensities. (W.D.M.)

5843

THE PHOTODISINTEGRATION OF MANGANESE AND RHODIUM. R. W. Parsons (Univ. of Queensland, Brisbane). Can. J. Phys. 37, 1344-8(1959) Dec.

The cross section for the production of photoneutrons from Mn^{55} and Rh^{103} was found by irradiating these elements in the x-ray beam of a 24-Mev betatron. For Mn^{55}, the giant resonance shows two distinct peaks and the intrinsic quadrupole moment is estimated to be 0.73 ± 0.14 barn; for Rh^{103}, two peaks cannot be resolved, but the shape of the giant resonance curve is consistent with an intrinsic quadrupole moment of approximately 2.1 barns. (auth)

5844

FINE STRUCTURE IN THE $O^{16}(\gamma,n)O^{15}$ YIELD CURVE. H. King (McMaster Univ., Hamilton, Ont.) and L. Katz (Univ. of Saskatchewan, Saskatoon). Can. J. Phys. 37, 1357-64(1959) Dec.

Fine structure in the $O^{16}(\gamma,n)O^{15}$ yield curve near threshold was examined using improved experimental techniques. Breaks were observed at threshold, 15.85, 16.14, 16.45, 16.74, 16.88, 17.05, 17.15, and 17.21 Mev. These energies are established to within ±0.04 Mev. The integrated photon absorption cross section in these breaks resulting in (γ,n) reactions was found to be 0.47 ± 0.11 Mev-mb. The results are in good agreement with the measurements of other workers. (auth)

5845

THE ANGULAR DISTRIBUTION OF PHOTOFISSION FRAG-

MENTS. A. P. Baerg, R. M. Bartholomew, and F. Brown (Atomic Energy of Canada Ltd., Chalk River, Ont.) and L. Katz and S. B. Kowalski (Univ. of Saskatchewan, Saskatoon). Can. J. Phys. 37, 1418-37(1959) Dec.

Angular distributions of photofission fragments relative to the photon beam were measured as a function of maximum bremsstrahlung energy in the range 6 to 20 Mev. The nuclides U^{233}, U^{235}, Np^{237}, Pu^{239}, and Am^{241} give an isotropic distribution at all energies studied. The nuclides Th^{232}, U^{234}, U^{236}, U^{238}, and Pu^{240} give anisotropic distributions which can be described by an equation of the form $W(\theta) = 1 + \alpha \sin^2 \theta$ where θ is the angle between fragment and beam. The degree of anisotropy is large at low energy and falls rapidly as the energy is increased. At a given energy Th^{232} has the greatest degree of anisotropy and Pu^{240} the least. (auth)

5846

STUDIES OF (p,n) REACTIONS IN THE PROTON ENERGY RANGE FROM 2 TO 10 Mev. D. A. Bromley, A. J. Ferguson, H. E. Gove, J. A. Kuehner, A. E. Litherland, and E. Almqvist (Atomic Energy of Canada Ltd., Chalk River, Ont.) and R. Batchelor (Atomic Research Establishment, Aldermaston, Eng.). Can. J. Phys. 37, 1514-47(1959) Dec.

Reaction thresholds were studied for (p,n) reactions on B^{11}, F^{19}, Al^{27}, Si^{30}, P^{31}, K^{39}, Ni^{58}, and Ni^{60}. Using the $C^{13}(p,n)N^{13}$ and $Cu^{65}(p,n)Zn^{65}$ thresholds, which were previously measured with precision, to calibrate the magnetic beam analyzer of the tandem accelerator, and the $H^2(O^{16},n)F^{17}$ threshold to establish the linearity of this calibration to an equivalent proton energy of 14.57 Mev, threshold energies of 3.019 ± 0.004, 4.229 ± 0.006, 5.800 ± 0.008, 5.174 ± 0.030, 6.456 ± 0.020, 7.227 ± 0.070, 9.480 ± 0.025, and 7.016 ± 0.015 Mev, respectively, were established. These data are in reasonable agreement with the available positron decay data except in the case of Ca^{39} where an unexplained discrepancy exists. Resonances of total width less than 20 kev were observed in the neutron-excitation curves of the $Al^{27}(p,n)Si^{27}$ and $Si^{30}(p,n)P^{30}$ reactions corresponding to excitations of approximately 17 and 13 Mev in the compound systems Si^{28} and P^{31}, respectively. In the latter case isolated resonances are found without overlapping broad resonances. The reaction threshold falls between resonances and is not directly observable; the counter-ratio technique was calibrated for use in such situations. Neutron yield measurements were made on thick targets of C, Al, $Ni^{64}O$, $Ni^{58}O$, Ni^{58}, W, Pb, Au, Th, and U as functions of the incident proton energy in the energy range from 4 to 10 Mev. (auth)

5847

THE MESON DECAY OF LIGHT HYPERFRAGMENTS. Zdeněk Korbel and Ladislav Rob (Faculty of Nuclear and Mechanical Physics, Prague). Czechoslov. J. Phys. 9, 288-90(1959). (In Russian)

The binding energies of five types of light hyperfragments, i.e., of atomic nuclei of light elements containing one hyperon instead of one neutron, were measured. The hyperfragments originated by means of the interaction of K^- mesons with the nuclei of light elements contained in the emulsion. (auth)

5848

DIRECT INTERACTION MECHANISM IN THE $Li^6(\alpha, d)Be^8$ REACTION. S. V. Starodubtsev and K. V. Makarunas. Doklady Akad. Nauk S.S.S.R. 129, 547-9(1959) Nov. 21. (In Russian)

Natural lithium was bombarded by 8.34- to 13.2-Mev α particles. The emitted secondary particles were recorded on photoplates (of 100μ thickness) distributed in the scattering chamber. The mean angle between the photoplates and particle motion from the target was 10°. An intense group of deuterons from the reaction $Li^6(\alpha, d)Be^8$, Q = 1.59, was detected. The angular distributions in the center of inertia system are plotted for α bombardment at 10.15, 11.5, and 13.2 Mev. The absolute magnitude of the differential cross section with E_α = 10.15 Mev at 58° is equal to 6.7 mb/steradian. The integral cross section, derived by angular distribution, at E_α = 10.15 is not less than 50 mb. The cross section diminishes with an energy increase from 10.15 to 13.2 Mev. The deuteron angular distribution indicates the presence of deuteron substructure in Li^8. (R.V.J.)

5849

LONGITUDINAL POLARIZATION OF β PARTICLES IN THE DECAY OF Pr^{144}. Dubravko Tadić (Instituta "Ruder Boskovic," Zagreb). Glasnik mat.-fiz. i Astron., Ser. II. 13, 267-72(1958). (In English)

The longitudinal polarization of β particles in weak interactions was calculated for $0^- \rightarrow 0^+$ transitions. The previously reported results for polarization in Pr^{144} decay were $-\vec{p}/W$ (ratio of the degree of polarization to neutrino number) on 10% and 0.9 + 0.2%. These results are explained with pure axial vector interaction utilizing a correction factor ≥ 1. The correction factor for polarization was computed for Pr-144 and Ho-166. (C.J.G.)

5850

PHOTONEUTRON CROSS SECTIONS FOR Ag^{107}, Mo^{92}, AND Zr^{90}. Naoshi Mutsuro, Yuji Ohnuki, Kazuo Sato, and Motoharu Kimura (Univ. of Sendai). J. Phys. Soc. Japan 14, 1649-53(1959) Dec. (In English)

Photoneutron cross sections and yield curves were determined by the residual activity method for Ag^{107}, Mo^{92}, and Zr^{90}. Threshold energy were obtained as 9.35 ± 0.1, 9.15 ± 0.1, 12.38 ± 0.1, and 12.3 ± 0.1 Mev for Ag^{107}, Ag^{109}, Mo^{92}, and Zr^{90} respectively. The energy for the maximum cross section was obtained as 14.5 Mev for Ag^{107}, 16.5 Mev for Mo^{92}, and 17 Mev for Zr^{90}. The giant resonance widths were measured about 5.3, 2.7, and 2.9 Mev respectively. Intrinsic quadrupole moment determined from above data was $(1.9 \pm 0.7) \times 10^{-24}$ cm^2 for Ag^{107}. (auth)

5851

AN APPROXIMATIVE COMPUTATION OF THE TOTAL BETA-ACTIVITY OF THE FISSION-PRODUCTS OF U-235. Rastislav Zezula (Ústav jaderného výzkumu ČSAV, Prague). Jaderná energie 5, 349-50(1959). (In Czech.)

An approximative formula for integration is derived for the beta activity of fission products of U^{235} (i.e., the number of beta-decays in 1 sec for 1 nucleus originating from the fission) as a function of the time t past the fission, in the interval 0.04 sec $\leq t \leq 8.64 \times 10^4$ sec. This approximation formula permits the total activity A (t; t−T) of the sample of U^{235} (irradiated with neutrons during T sec) in a time t−T (sec) elapsed after irradiation is finished to be computed. For control, a simple formula was derived for numerical integration of a function, given graphically by approximative parabolic segment in the double logarithmic scale. The total activity function A (t; t−T) enables one to compute the beta activity of the suspension in a homogeneous reactor, designed in a Geneva report. The influence of the clear-on mechanism was also derived and computed. (auth)

5852

THE MEDIUM AND HIGH ENERGY OPTICAL MODEL AND THE CORRELATIONS IN THE NUCLEAR WAVE FUNCTION. J. Dabrowski (Instute for Advanced Study, Prince-

ton, N. J.) and J. Bawicki (Princeton Univ., Princeton, N. J.). Nuclear Phys. 13, 621-41(1959) Nov.(3)

Watson's multiple scattering theory is applied to calculate the well depths of the nuclear optical potential for the case of strongly correlated nuclear matter. The nuclear ground state is represented by a Jastrow type wave function. The consequences of the Bethe-Goldstone equation for the correlation functions are considered. The numerical results obtained for the case of a separable nucleon-nucleon interaction show that the effects of the correlations amount to corrections to the Fermi model case up to the order of 10 per cent in the medium and high energy range. The evaluated corrections due to the incoherent multiple scattering appear to be important. (auth)

5853

GAMMA RAY CASCADES IN O^{15}. D. F. Hebbard and B. Povh (California Inst. of Tech., Pasadena). Nuclear Phys. 13, 642-54(1959) Nov. (3)

The gamma rays from the reaction $N^{14}(p,\gamma)O^{15*}$ were investigated over the proton energy range from 950 to 1560 kev. It was found that the 8.29-Mev level (1060-kev resonance) in O^{15} cascades weakly through a level at 7.17 Mev and through the known level at 6.15 Mev, in addition to the transitions already known to the 5.2-Mev levels and the ground state. The radiative widths of the 8.29-Mev level for transitions to the ground state, 5.2-Mev levels, 6.15-Mev level, and 7.17-Mev level are respectively 0.54, 0.33, 0.06, and 0.02 ev. The non-resonant production of O^{15} in the above proton energy range is almost entirely accounted for by a transition through the 6.79-Mev level in O^{15}. At the 8.75-Mev level (1550-kev resonance) the transitions to the ground state, 5.2-Mev states, 6.8-Mev states, and 7.17-Mev state all appear to be weakly resonant. (auth)

5854

SUPERFLUIDITY AND THE MOMENTS OF INERTIA OF NUCLEI. A. B. Migdal (Atomic Energy Inst. of USSR, Academy of Sciences, Moscow). Nuclear Phys. 13, 655-74 (1959) Nov. (3).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20569.

5855

A PRECISE DETERMINATION OF THE TOTAL CROSS SECTION OF URANIUM-235 FROM 0.000818 ev TO 0.0818 ev. G. J. Safford, W. W. Havens, Jr., and B. M. Rustad (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 6, 433-40(1959) Nov.

The absolute value of the total neutron cross section of U^{235} was measured for neutrons in the energy range 0.000818 to 0.0818 ev for two types of samples, metallic foils and D_2O solutions of uranium. Balanced solutions of $U^{235}O_2(NO_3)_2$ and $U^{238}O_2(NO_3)_2$ were used to determine the difference between the total cross sections of U^{235} and U^{238}. This value when combined with the relatively small, known value of the total cross section for U^{238} gives $\sigma_T(U^{235}) = 695.0 \pm 1.8$ barns at 0.0253 ev. The measurements on the metallic U^{235} foils agreed with the measured total cross section determined from the liquid solution data to better than 1%, yielding $\sigma_T(U^{235}) = 698.7 \pm 4.7$ barns at 0.0253 ev. The measured value of the U^{235} total cross section at 0.00291 ev combined with the scattering cross section, a recent precise value of $(1 + \alpha)$ at 0.00291 ev, and the ratio $\sigma_f(0.0253\text{ ev})/\sigma_f(U^{235}) = 590.8 \pm 5.4$ barns at the standard neutron energy of 0.0253 ev. (auth)

5856

EFFECTIVE CADMIUM CUTOFF ENERGIES. R. W. Stoughton, J. Halperin, and Marjorie P. Lietzke (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 6, 441-7 (1959) Nov.

Effective cutoff energies for point 1/v absorbers inside of spherical and cylindrical cadmium filters were calculated for thermal reactor neutrons. The neutron spectrum was assumed to consist of a Maxwellian plus a 1/E component, and the parameters varied with the thickness of filter, the Maxwellian temperature, and the Maxwellian to 1/E flux ratio. Because of the sensitivity of the effective cutoff to Maxwellian flux parameters for thin filters it is recommended that filter thicknesses of about 40 mils be used. Forty-mil filters show effective cutoffs at about 0.50 to 0.55 ev for temperatures up to about 500°A (or about 0.045 ev). Effective cutoff energies for boron filters were also calculated for purposes of comparison. (auth)

5857

RAPID ASSESSMENT OF NEUTRON ACTIVATION. Russell B. Mesler (Univ. of Kansas, Lawrence). Nucleonics 18, No. 1, 73-5(1960) Jan.

A simple method for computing the specific activity produced by an exposure to thermal neutrons is presented. It requires only the identities of the product nuclides, reactor flux, and exposure time. The values given for the saturated specific activities and the mean life of the nuclides are those produced upon exposure of the natural elements to a thermal flux of 10^{11} n/cm²/sec. The accuracy for exposure times less than one-tenth of the mean life and greater than three mean lives are within 5%. (B.O.G.)

5858

COOLANT BLOCK DAMAGES SRE FUEL. Robert W. Dickinson (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 18, No. 1, 107; 109-11(1960) Jan.

The Sodium Reactor Experiment (SRE) was shut down on July 27, 1959, to determine the cause of the wide temperature variations in the fuel channels. It was found that a leak of organic material from an auxiliary cooling system into the primary loop caused blocking of the coolant passages. Upon examination twelve fuel elements of the 43 initially installed were damaged. A further study revealed that a possible iron-uranium eutectic had formed. Although this takes place at about 1,340°F, the temperature monitoring system indicated a maximum of only 900°F. Some future plans for SRE operation are discussed. (B.O.G.)

5859

DISTRIBUTION CORRELATIONS IN Sb(n,p)Sn. R. A. Peck, Jr., H. P. Eubank, and R. M. Howard (Brown Univ., Providence). Nuovo cimento (10) 14, 397-402(1959) Oct. 16. (In English)

The reaction Sb(n,p)Sn was studied at 14 Mev and over the ranges 0 to 3 Mev excitation and angles of 0 to 60°. It is demonstrated that the forward-peaked contribution is relatively concentrated at high proton energy and gives rise to most of the spectral group structure, and that the angle-insensitive portion has a smooth spectrum rising with decreasing proton energy. The isotropic portion does not fit the theoretical compound nucleus spectrum but is consistent with a process of incomplete compound nucleus formation. Total cross-section for the ranges of energy and angle studied is (22 ± 4) mb, of which 20% is the anisotropic contribution. (auth)

5860

MATHEMATICAL ANALYSIS OF A SIMPLE MODEL RELATED TO THE STRIPPING REACTION. Elliott Lieb and

Heinz Koppe (Univ. of Illinois, Urbana). Phys. Rev. 116, 367-71(1959) Oct. 15.

A scattering process in which an incoming bound particle can split up into its component parts when its total energy is above a threshold is of considerable interest physically (deuteron stripping, etc.) and mathematically (analytic properties of the S-matrix, etc.). For such complicated problems it is obviously convenient to have a simple, analytically soluble model for reference, but although many models have been suggested in the past none have proved analytically tractable. A one-dimensional model is proposed and solved which, although it is not very physical, has all the desired characteristics. The problem is not mathematically trivial, however, and leads to a Wiener-Hopf integral equation. (auth)

5861

SURFACE COUPLING MECHANISM FOR APPROACHING STATISTICAL EQUILIBRIUM IN COMPOUND NUCLEUS FORMATION, WITH APPLICATION TO FISSION. Lawrence Wilets (Univ. of Washington, Seattle). Phys. Rev. 116, 372-82(1959) Oct. 15.

In a particular representation where the state vectors are not eigenstates of the Hamiltonian, coupling terms remain which cause "virtual" or "real" transitions among states. An appropriate choice of representation depends upon the physical processes involved. The decay of a compound nucleus, especially by fission, is considered. The strong coupling representation of the unified model is employed, with surface oscillations inducing transitions among states of the representation. A diffusion equation is derived to describe the flow of probability among the states available within constraints. An estimate of the characteristic relaxation time for arriving at statistical equilibrium is obtained. Only when the relaxation time is short compared with a basic reaction time are statistical arguments valid to evaluate the reaction rate. As an example the relevant reaction time in the fission process is a collective vibrational period. The necessary condition appears to be satisfied for excitation energies more than a few Mev above threshold. Arguments are presented to show why equilibrium may not be maintained at lower energy. Thus the usual estimate of the number of open channels, $2\pi\bar{\Gamma}_f/D$, would give a number lower than what one would estimate simply from penetrability of the fission barrier. This seems to explain, at least in part, the anomalously low numbers of channels obtained in this manner. Problems relating to the validity of oft made statistical assumptions at scission are also discussed. (auth)

5862

SPALLATION-FISSION COMPETITION IN HEAVY-ELEMENT REACTIONS: Th^{232} + He^4 AND U^{233} + d. Bruce M. Foreman, Jr., Walter M. Gibson, Richard A. Glass, and Glenn T. Seaborg (Univ. of California, Calif.). Phys. Rev. 116, 382-92(1959) Oct. 15.

Cross sections and excitation functions were determined for spallation and fission products from bombardments of Th^{232} with helium ions (15 to 46 Mev) and U^{233} with deuterons (9 to 24 Mev). This work extends a series of investigations of charged particle (α, d, and p) induced reactions in heavy elements ($Z \geq 88$). Radiochemical methods were employed to isolate products corresponding to the following spallation reactions: neutron emission, (α,4n), (α,5n), (d,n), (d,2n), and (d,3n); emission of one proton and neutrons (α,p), (α,pn), (α,p2n), and (α,p3n); and emission of two protons and neutrons, (α,2p), (α,2pn), and (α,αn), and (d,αn). In addition, the following fission products were isolated from one or more bombardments: Zn^{72}, Ge^{77}, As^{77}, $Br^{82,83}$, Rb^{86}, $Sr^{89,91}$, Y^{93}, $Zr^{95,97}$, Nb^{96}, Mo^{99}, $Ru^{103,105,106}$, $Pd^{109,112}$, Ag^{111}, $Cd^{115,115m,117}$, $I^{131,133}$, Cs^{136}, $Ba^{139,140}$, La^{140}, $Ce^{141,143,144}$, Nd^{147}, Eu^{157}, and Gd^{159}. The results show that fission is the predominant reaction at all energies for Th^{232} and to an even greater extent for U^{233}. The data for the surviving spallation products are consistent with several mechanisms of reaction, including compound-nucleus formation and evaporation, direct interactions between nucleons of the incoming helium ion or deuteron and nucleons of the nucleus, and a combination of these types of processes (direct interaction followed by evaporation). In general, the results confirm and extend previously established concepts. The neutron-emission spallation reactions as well as fission are best explained as proceeding through compound-nucleus formation. The shapes and magnitudes of (α,4n), (d,2n), and (d,3n) excitation functions correlate well with a compound-nucleus treatment modified to include fission competition. According to this treatment, ratios of neutron to total-reaction level width, $\Gamma_n/\Sigma_i\Gamma_i$, are 0.49 for $U^{230-233}$ [from Th^{232}(α,4n)], 0.17 for $Np^{235-234}$ [from U^{233}(d,2n)], and 0.20 for $Np^{235-233}$ [from U^{233}(d,3n)]. In addition the total-reaction excitation functions (consisting mostly of the fission excitation functions) are consistent with theoretical cross sections for compound-nucleus formation calculated with a nuclear radius parameter $r_0 = 1.5 \times 10^{-13}\ A^{1/3}$. The fission mass-yield curves are similar to those found for other heavy target isotopes (for elements from thorium to plutonium). The minimum in the curves in the region of mass 120 tends to disappear as helium-ion or deuteron energy is increased. The (α,pxn), (α,2pxn), (α,αn), (d,n), and (d,αn) products are attributed to direct interactions, with complex particles emitted in preference to a series of protons and neutrons. Thus (α,d), (α,t), and (α,tn) mechanisms would account for most of the (α,pn), (α,p2n), and (α,p3n) products, respectively. In the case of the (α,t) and (α,tn) reactions, analysis of the ratio $\sigma(\alpha,tn)/\sigma(\alpha,t)$ leads one to the conclusion that with 35-Mev helium ions only 9% of outgoing tritons leave the residual nucleus with sufficient energy to evaporate a neutron or undergo fission, and with 44-Mev helium ions only 20% do so. The (d,n) product probably results from the stripping reaction. (auth)

5863

HYPERFINE STRUCTURE AND NUCLEAR MOMENTS OF BROMINE-82. Hugh L. Garvin, M. Green, Edgar Lipworth, and William A. Nierenberg (Univ. of California, Berkeley). Phys. Rev. 116, 393-401(1959) Oct. 15.

The nuclear spin, the magnetic dipole, and the electric quadrupole interaction constants were measured for 35-hr bromine-82 by the method of atomic beams. The results are I = 5, $|a| = 205.04 \pm 0.05$ Mc/sec, $|b| = 870.7 \pm 0.9$ Mc/sec, and $b/a = -4.246 \pm 0.001$. The nuclear magnetic and electric quadrupole moments obtained from these values of a and b are $|\mu| = 1.6264 \pm 0.0005$ nm, and $|Q| = 0.76 \pm 0.03$ barn. While only the relative sign of μ and Q is determined, both μ and Q are almost certainly positive. A new method for solving the interaction Hamiltonian with magnetic field, for arbitrary I and J, by using an IBM 650 computer, is described. (auth)

5864

PLAUSIBILITY OF A NONLOCAL OPTICAL MODEL. Y. C. Tang, R. H. Lemmer, P. J. Wyatt, and A. E. S. Green (Florida State Univ., Tallahassee). Phys. Rev. 116, 402-6(1959) Oct. 15.

The implication of a simple two-kernel form of nonlocal potential is considered in the nuclear matter approxima-

tion. It is shown that this leads to a wave equation with a complex reduced mass. The parameters characterizing the real part of the optical potential are found to be in reasonable accord with expectations from two-body forces. The parameters associated with the imaginary part are handled only phenomenologically. A description is found which works quite well in the energy range 0 to 25 Mev. The results of this study compares favorably with the corresponding results of an investigation with a nonlocal model for finite nuclei. (auth)

5865

MASS ASSIGNMENTS AND SOME DECAY CHARACTERISTICS OF Gd^{145}, Eu^{145}, Gd^{146}, AND Eu^{146}. J. Robb Grover (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 406-12(1959) Oct. 15.

The nuclides Gd^{145}, Eu^{145}, Gd^{146}, and Eu^{146} were prepared by the interactions of 20- to 40-Mev helium ions with Sm^{144}, and found to decay with half-lives of 25 ± 2 minutes, 5.6 ± 0.3 days, 46 ± 2 days, and 4.4 ± 0.1 days, respectively. The mass number assignments were made on the basis of excitation functions, and chemical evidence of parent-daughter relationships, with special reference to the previously known nuclide Eu^{145}. The most prominent gamma rays appearing in the decay of each of these four nuclides are as follows: in Gd^{145} decay, at 0.80, 1.03, and 1.75-Mev; in Eu^{145} decay, at 0.53, 0.64, and 0.89 Mev; in Gd^{146} decay, at 0.114 and 0.153 Mev; and in Eu^{146} decay, at 0.63 and 0.74 Mev. There is also a strong K x-ray line in each spectrum. In addition, Gd^{145} was found to emit positrons with an end-point energy of about 2.4 ± 0.2 Mev. (auth)

5866

REACTIONS OF ALPHA PARTICLES WITH GERMANIUM-70 AND ZINC-70. Saadia Amiel (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 415-17(1959) Oct. 15.

The reactions $Ge^{70}(\alpha,2n)Se^{72}$, $Ge^{70}(\alpha,pn)As^{72}$, $Zn^{70}(\alpha,pn)Ga^{72}$, and $Zn^{70}(\alpha,2p)Zn^{72}$ were studied with alpha particles of 20 to 40 Mev, and their excitation functions were measured. The results are compared with evaporation calculations based on the assumption of compound-nucleus formation. (auth)

5867

TOTAL REACTION AND ELASTIC SCATTERING CROSS SECTIONS FOR 22.8-Mev PROTONS ON URANIUM ISOTOPES. Clyde B. Fulmer (Oak Ridge National Lab., Tenn.). Phys. Rev. 116, 418-23(1959) Oct. 15.

The total reaction cross sections for 22.8-Mev protons on uranium isotopes were determined by measuring cross sections for (p, fission), (p,p′), (p,d), (p,t), and (p,α). These data are combined with previously measured (p,xn) cross sections to give total reaction cross sections of 1.43 ± 0.10, 1.44 ± 0.10, and 1.39 ± 0.10 barns for 22.8-Mev protons on U^{233}, U^{235}, and U^{238}, respectively. Angular distributions of (p,p′), (p,d), (p,t), (p,α), and proton elastic scattering cross sections are shown for U^{235} and U^{238}. (auth)

5868

MODIFIED HARTREE-FOCK METHOD FOR THE FINITE NUCLEUS. K. A. Brueckner and D. T. Goldman (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 116, 424-5(1959) Oct. 15.

A procedure is given for including the rearrangement energy term in the Brueckner-Gammel method for evaluating the structure of finite nuclei. A variational technique is used to derive the single-particle energy from the total binding energy of the nucleus. It is seen that although a rearrangement energy term does not appear explicitly in the total nuclear binding energy, it is derivable from the binding energy and influences the eigenfunctions of the total nuclear system, and thus its energy eigenvalues. The rearrangement energy has a noticeable effect on the singleparticle wave equation and must be included in finite nucleus calculations. To a good approximation, it is shown that it is possible to evaluate the rearrangement potential and to express it as a simple function of the mean nuclear density, i.e., $V_R = (240\ \text{Mev})\rho^2 \times (10^{-13}\ \text{cm})^6$. (auth)

5869

REACTION MECHANISM IN DIRECT INTERACTION INELASTIC SCATTERING. Bernard L. Cohen (Univ. of Pittsburgh). Phys. Rev. 116, 426-7(1959) Oct. 15.

It is pointed out that experimental results indicate very striking similarities between (p,p′) and (d,d′) reactions, and very striking differences between (p,p′) and (p,n) reactions. It is shown that this is in strong disagreement with the nucleon-nucleon collision model commonly used in interpreting (p,p′) reactions, but in agreement with the recent inelastic diffraction scattering model of Blair. (auth)

5870

EFFECT OF NUCLEAR FORCES ON THE CROSS SECTIONS OF PHOTONUCLEAR REACTIONS. K. Okamoto (Louisiana State Univ., Baton Rouge). Phys. Rev. 116, 428-36(1959) Oct. 15.

The effect of nuclear forces, or the effect of the quasi-deuteron model, is discussed for the integrated cross section and the bremsstrahlung weighted cross section. The nuclear force is assumed to be of partly Majorana exchange character. Only the central force is considered. The two-body potential is a Gaussian type without a hard core, the parameters of which are taken from the effective range theory. The calculations are performed by first-order perturbation theory and the results are that the integrated cross section is increased by about ten percent and the bremsstrahlung weighted cross section is decreased by a few percent. Therefore the independent-particle model can be regarded as a good approximation for photonuclear reactions. (auth)

5871

ELECTROMAGNETIC CORRECTIONS TO ISOTOPIC SPIN CONSERVATION. S. Weinberg (Columbia Univ., New York) and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 116, 465-8(1959) Oct. 15.

If electromagnetic interactions are wholly responsible for all departures from isotopic spin invariance, then the strict conservation law $\Delta T = 0$ may be replaced, to order e^2, by the rule $|\Delta T| \leq 2$. Consequences of this weaker restriction are discussed for elementary particle masses, scattering processes, and weak-interaction decay processes. The apparent absence in nature of particles with isotopic spins greater than one makes it difficult to find very practical experimental tests of this rule. (auth)

5872

MECHANISM OF TRANSFER REACTIONS WITH HEAVY IONS. A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 4, 21-3(1960) Jan. 1.

A heavy-ion transfer reaction is one in which only a small portion of the nuclear matter is transferred from one nucleus to the other, presumably without the formation of a compound system. It was found the neutron transfer reactions are strongly Q-dependent and that their cross sections increase with energy rather slowly once a critical energy is reached. Several reaction transfer mechanisms are compared for previous studies. (B.O.G.)

5873

BETA-ALPHA ANGULAR CORRELATIONS IN B^8 AND Li^8. M. E. Nordberg, B. Povh, and C. A. Barnes (California Inst. of Tech., Pasadena). Phys. Rev. Letters 4, 23-5 (1960) Jan. 1.

A comparison of the $\beta-\alpha$ angular correlations in the isotopic spin triplet of mass 8(Li^8, Be^8, B^8) is suggested as a test of the conserved vector current theory of β decay. The $\beta-\alpha$ angular correlations in Li^8 and B^8 were measured and found to differ by about one-fourth that predicted. The results suggest that the ratio of coincident counts at 180° to the counts at 90° for Li^8 to the ratio for B^8 was 1.02 ± 0.04 compared to the predicted value of 1.15 or 0.85. (B.O.G.)

5874

DECAY OF OXYGEN 20. Gertrude Scharff-Goldhaber (Brookhaven National Lab., Upton, N. Y.) and Albert Goodman and Myron G. Silbert (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Letters 4, 25-7(1960) Jan. 1.

The decay of O^{20} produced by 2.66-Mev tritons in an O^{18} (95% enriched) gas target was studied. A computer analysis of a mixture of $O^{20}-F^{20}$ corrected for background yielded a halflife of 12.4 ± 0.1 sec. Using the measured F^{20} half life of 11.2 sec, the half life of O^{20} was found to be 13.5 ± 1.0 sec. (B.O.G.)

5875

OBSERVATIONS ON THE MÖSSBAUER EFFECT IN Fe^{57}. S. S. Hanna, J. Heberle, C. Littlejohn, G. J. Perlow, R. S. Preston, and D. H. Vincent (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 4, 28-9(1960) Jan. 1.

The magnitude of Mössbauer absorption for sources and absorbers was measured at room temperature and when cooled with liquid nitrogen. The methods of preparing sources and absorbers are discussed. The transmission was measured as a function of the relative velocity between source and absorber. If the assumption is made that the fraction of nuclei in the source which emit without recoil is approximately equal to the fraction in the absorber which absorb without recoil, analysis of the curves obtained by the area method gives a value of 0.6. This number is in good agreement with the theoretical value of 0.7 calculated for room temperature. (B.O.G.)

5876

THE LEVEL SCHEME OF Cd^{112}. R. K. Girgis and R. Van Lieshout (Instituut voor kernphysisch Onderzoek, Amsterdam). Physica 25, 1200-10(1959) Nov. (In English)

The level scheme of Cd^{112} was investigated by studying the gamma spectrum from the decay of Ag^{112} which excites levels in this nucleide. A source of $Pd^{112}-Ag^{112}$ in equilibrium was used. Gamma rays of 615, 690, 785, 855, 980, 1090, 1210, 1310, 1400, 1490, 1620, 1810, 1930, 2110, 2240, 2300, 2520, 2540, 2680, 2710, 2830, 2950, 3100, and 3280 kev were found to follow the decay of Ag^{112}. The summing spectrum was examined using a well type NaI(Tl) crystal with the source in different geometries; summing peaks of 3560, 3300, 3130, 2830, 2710, 2450, 2230, and 2050 kev were observed. Gamma-gamma coincidences were performed using a conventional fast-slow coincidence circuit. The results of these coincidence measurements are listed. A level scheme for Cd^{112}, based on the intensity values of the various gamma rays following the decay of Ag^{112} and on the summing and gamma-gamma coincidence measurements is presented. (auth)

5877

ON THE ANGULAR DISTRIBUTION OF (d,p) STRIPPING REACTIONS. T. Honda and M. Nagasaki (Rikkyo Univ., Tokyo). Proc. Phys. Soc. (London) 74, 517-28(1959) Nov. 1.

It is numerically investigated how the angular distributions of some typical (d,p) stripping reactions given by the Butler theory are modified by the supposition that in a simple (d,p) stripping process protons do not penetrate into the nucleus, in contrast to the assumption of the Butler theory that protons move freely even in the nucleus. The result of the calculation shows that the general trend of the angular distrubutions given by the present model gives a better fit to the experimental data than that given by the Butler theory, though it is not greatly altered in both relative and absolute values in the cases of relatively light nuclei and high incident energies. The best fit nuclear radii determined by the present model are found to be given by the Gamow–Critchfield formula $a = (1.22A^{\frac{1}{3}} + 1.70) \times 10^{-13}$ cm. These nuclear radii are smaller than some of the best fit nuclear radii obtained in the analyses hitherto done by using the Butler theory. (auth)

5878

CROSS SECTIONS FOR SOME (n,pn) REACTIONS WITH HEAVY NUCLIDES. J. F. Barry, R. F. Coleman, B. E. Hawker, and J. L. Perkin (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London) 74, 632-8(1959) Nov. 1.

The (n,pn) cross sections of five heavy nuclides for 14.5 Mev neutrons were measured using activation methods. The variation of both the (n,pn) and (n,p) cross sections of W^{186} with neutron energy in the range 13 to 22 Mev was also investigated. All the cross sections found were compared with those calculated using the direct interaction theory of Brown and Muirhead. (auth)

5879

1.12 MEV LEVEL IN ^{18}F. K. W. Allen, D. Eccleshall, and M. J. L. Yates (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London) 74, 660-2(1959) Nov. 1.

Decay studies on three energy levels of F^{18} were performed; 0.930 Mev (prompt α rays), 1.08 Mev (prompt α rays), and 1.12 Mev (delayed α rays). The decay of the 1.12-Mev level of F^{18} was of particular interest. The lifetime of the three levels was found to be less than 10^{-8} second for the 0.93- and 1.08-Mev levels and 0.1×10^{-6} second for the 1.12-Mev level. (B.O.G.)

5880

MEASUREMENT OF THE SPONTANEOUS FISSION NEUTRON YIELD OF NATURAL URANIUM. A. W. Waltner and B. E. Leonard (North Carolina State Coll., Raleigh). Reactor Sci. 11, 1-7(1959) Nov.

A measurement of the spontaneous fission neutron yield of natural uranium was made by the activation of approximately 1500 l. of $KMnO_4$ solution in a sub-critical assembly containing over 5000 lb of natural uranium. By filtering a large volume of this solution, sufficient manganese activity is removed as MnO_2 by the Szilard-Chalmers effect to provide an accuracy of 1.5% in the result. However, since the total efficiency of MnO_2 extraction process was not known to this high degree of accuracy, comparison of the activation by Pu-Be sources of known strength superimposed over the uranium was made. This provided the spontaneous fission neutron yield of natural uranium in terms of the Pu-Be source calibration. A value of (1.532 ± 0.061) × 10^{-2}/sec per g was obtained. (auth)

5881

THE SLOW NEUTRON TOTAL CROSS-SECTION OF ^{240}Pu. N. J. Pattenden and V. S. Rainey (Atomic Energy Research

Establishment, Harwell, Berks, Eng.). Reactor Sci. 11, 14-18(1959) Nov.

The total cross-section of Pu^{240} was measured at 0.01 ev to 10 ev, using crystal spectrometers. The observations may be fitted by a single-level Breit-Wigner relation with parameters $E_0 = 1.0575$ ev, $\Gamma\gamma = 29.6$ Mev, and $\Gamma_n^0 = 2.40$ Mev. The results are compared with data obtained by other workers. (auth)

5882

THERMAL NEUTRON $\bar{\nu}$ FOR ^{241}Pu. Arthur H. Jaffey, Carl T. Hibdon, and Ruth Sjoblom (Argonne National Lab., Lemont, Ill.). Reactor Sci. 11, 21-30(1959) Nov.

The average number of neutrons per fission, $\bar{\nu}$, of Pu^{241} was measured at thermal energies relative to Pu^{239}, U^{235}, and U^{233}. The measurement yielded the product of $\bar{\nu}$ and the effective fission cross-section $(g\sigma_f)\bar{\nu} = 3162 \pm 72$ barn neutrons/fission. Using a measured value $(g\sigma_f) = 1070 \pm 14$ barn, a value of $\bar{\nu} = 2.96 \pm 0.08$ neutrons/fission was calculated. (auth)

5883

THE VALUE OF TRANSPORT MEAN FREE PATH FOR D_2O. D. W. Hone (Atomic Energy of Canada Ltd., Chalk River, Ont.). Reactor Sci. 11, 34(1959) Nov.

Corrections are made on the value of the transport mean free path for thermal neutrons in heavy water in reference to the work of P. Auger, A. M. Munn, and B. Pontecorvo (Canad. J. Res. A25, 143(1947)). The corrected value is 2.60 ± 0.10 cm at 22°C. (C.J.G.)

5884

THE RATE OF EMISSION OF SPONTANEOUS FISSION NEUTRONS BY NATURAL URANIUM. D. J. Littler (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Reactor Sci. 11, 34(1959) Nov.

Corrections are made on the value of the spontaneous fission neutron yield of natural uranium reported by D. J. Littler (Proc. Phys. Soc. A65, 203(1952)). The corrected value is $(1.52 \pm 0.05) \times 10^{-2}$ n/sec/g. (C.J.G.)

5885

DOUBLE BETA DECAY. H. Primakoff and S. P. Rosen (Washington Univ., St. Louis). Repts. Progr. in Phys. 22, 121-66(1959).

The phenomenon of double beta decay is discussed both from the experimental and from the theoretical point of view, the relation between double beta decay and the possible kinds of inverse beta decay being also briefly treated. A summary of the available experimental data is given, all methods of detection of the various double beta decay processes being considered. The theory of double beta decay, both in the no-neutrino and in the two-neutrino cases, is worked out, ab initio, on the basis of a nucleon-lepton interaction without conservation of parity. It is particularly emphasized that, with a 'two-component neutrino' type nucleon-lepton interaction without conservation of parity, absence of no-neutrino $\beta\beta$ decay does not by itself uniquely imply that neutrino and anti-neutrino are distinguishable and that the total lepton charge is conserved. Comparison of the experimental limits on the double beta decay half-lives with the corresponding theoretical values indicates that two neutrinos are emitted together with two electrons in each double beta decay process however this conclusion is not definitely established. A treatment is given of the implications of the actual occurrence of two-neutrino rather than no-neutrino double beta decay for the problems of neutrino-anti-neutrino identity and conservation of total lepton charge. It is concluded, on the basis of the available double beta decay, inverse beta decay and muon decay experimental data and the provisional assumption of the universal applicability of 'two-component neutrino' type coupling, that a 'Dirac' neutrino occurs in double beta decay which is operationally distinguishable from a 'Dirac' anti-neutrino, and that conservation of total lepton charge is valid in all neutrino interactions. (auth)

5886

PREDICTION OF π^+ PHOTOPRODUCTION BY THE DISPERSION METHOD. K. Dietz and G. Höhler (Universität Munich). Z. Naturforsch. 14a, 994-6(1959) Nov. (In German)

Data on pion-nucleon scattering are presented and discussed. It is concluded that an important part of the deviations observed are connected with the selection of scattering data used, and that it would be premature to speak of a serious discrepancy between dispersion-method predictions and experiment. (T.R.H.)

5887

POLARIZATION OF THE NUCLEAR RESONANCE FLUORESCENCE OF GERMANIUM-74. Otto Zehender (Universität, Erlangen, Ger.). Z. Physik 157, 219-31(1959) Oct. (In German)

The gamma radiation of a gaseous As^{74}–Ge^{74} preparation was used for excitation of the 596-kev levels of Ge^{74}. The degree of polarization of gamma quanta resonance scattered at about 99 and 135° was studied with a Compton total-absorption polarimeter. The sign and magnitude of the polarization characterize the radiation as an E2 transition and thus the 596-kev level as the 2^+ state. (tr-auth)

5888

CALCULATION OF π^0 PHOTOPRODUCTION FROM SCATTERING. G. Höhler and A. Millensiefen (Universität, Munich). Z. Physik 157, No. 1, 30-53(1959). (In German)

The cross section for π^0-production is calculated from the results of the dispersion relation approach of Chew, Goldberger, Low, and Nambu and compared with the experimental data. The predictions are made using the measured values of all scattering phase shifts. A fit of the theoretical result to $\sigma(90°)$ between 260 and 370 Mev gives $f^2 = 0.082$. There is no systematic deviation from the predictions for $\sigma(90°)$ up to $E_\gamma = 450$ Mev. The general behavior of the asymmetry coefficient B is correct. A quantitative comparison which would show the contribution of the unknown electric dipole term $N^{(+)}$ of Chew et al., is only reasonable after the calculation of B and the measurements have been improved. C/A depends strongly on the small phases up to 240 Mev. The effects of the small phases are pretty large for $\sigma(150°)$ but there is no discrepancy similar to the results for π^+-production above 290 Mev. The formula for the cross section does not reduce to the results of the phenomenological theories if the simplifications made are taken into account. The origin of the differences is discussed. (auth)

5889

SMALL-ANGLE SCATTERING BY COLLISIONS BETWEEN NEUTRAL ATOMS. Hans Pauly (Universität, Bonn). Z. Physik 157, No. 1, 54-64(1959). (In German)

For the scattering of atomic alkali beams by mercury atoms the angular distribution of the scattered intensity at small angles has been investigated. The results confirm earlier theoretical estimations, by which the total collision cross-section and the differential cross-section at small angles for the colliding particles used in these experiments should be almost entirely determined by the van der Waals forces. The measured angular distribution can be calculated down to angles of a few minutes of arc by means of classical mechanics. For deviations at

smaller angles a quantum mechanical approximation can be given. Moreover the results allow the determination of the total collision cross-section as a function of the angular resolution of the apparatus. Hereby information can be obtained about the critical angle, smaller which the angular resolution in an atomic beam experiment has to be in order to measure the right value of the total cross-section. (auth)

5890

GAMMA SPECTRUM OF Se^{81}. I. Y. Krause, W.-D. Schmidt-Ott, K.-W. Hoffmann, and A. Flammersfeld (Universität, Göttingen, Ger.). Z. Physik 157, No. 1, 106-11(1959). (In German)

The decay of Se^{81} (18 min) produced by neutron bombardment of natural Se and 98% enriched Se^{80} has been studied with the aid of scintillation-spectrometers. Gamma-rays have been observed and could be identified as belonging to the decay of Se^{81}, revealing three excited levels in Br^{81} at (282 ± 3) kev, (565 ± 6) kev and (820 ± 10) kev. The branching ratios of the beta-components are 98.7% leading to the ground state and (0.06 ± 0.03)%, (0.85 ± 0.20)% and (0.40 ± 0.10)% leading to the excited states, respectively. The 565 kev-level decays to the ground state directly or by a cascade-transition with nearly equal intensities, the 820 kev-level mainly by a direct transition. (auth)

5891

SPECTRUM OF THE INTERNAL CONVERSION ELECTRONS ACCOMPANYING α-DECAY OF U^{233} AND THE LEVEL SCHEME OF Th^{229}. E. F. Tret'yakov, M. P. Anikina, L. L. Gol'din, G. I. Novikova, and N. I. Pirogova. Zhur. Eksptl'. i Teoret Fiz. 37, 917-27(1959) Oct. (In Russian)

The spectrum of internal conversion electrons emitted by Th^{229} (daughter nucleus of U^{233}) was studied in a β spectrometer with a toroidal magnetic field in conjunction with an $e-\alpha$ coincidence circuit. The existence of a rotational level which corresponds to the ground level of Th^{229} was confirmed. The energies of the rotational levels were determined with better accuracy. Gamma transitions starting from some new levels (29.1, 71.4, 320.0, and 366.0 kev and apparently 131.0 kev) were detected and investigated. Some refinements were introduced in the U^{233} α spectrum. The level scheme of Th^{229} is discussed. (auth)

5892

RADIOACTIVE DECAY OF Ac^{227} AND EXCITED LEVELS of Fr^{223} AND Th^{227}. G. I. Novikova, E. A. Volkova, L. L. Gol'din, D. M. Ziv, and E. F. Tret'yakov. Zhur. Eksptl'. i Teoret. Fiz. 37, 928-37(1959) Oct. (In Russian)

Radioactive decay of Ac^{227} was investigated. Alpha decay of Ac^{227} was studied with an α spectrometer. A β spectrometer in conjunction with an $\alpha-\beta$ coincidence circuit was employed to study β decay and the spectra of conversion electrons which accompany α and β decay of Ac^{227}. A fine structure has been detected in the Ac^{227} α spectrum. The energies of 7 new lines and the intensities of the corresponding transitions were determined. A number of γ transitions between levels of the daughter Fr^{223} nucleus were detected. A level scheme for Fr^{223} is proposed. Three levels were detected in the spectrum of Th^{227} which is obtained as a result of β decay of Ac^{227}. The energies of the levels and the intensities of β-decay to them were measured. (auth)

5893

ON APPLICATION OF THE POTENTIAL BARRIER CRITERION TO A STUDY OF DISINTEGRATIONS IN NUCLEAR EMULSIONS. P. I. Fedotov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 944-9 (1959) Oct. (In Russian)

Disintegrations induced by 660 Mev protons in carbon imbedded as small diamond particles in nuclear emulsions and also disintegrations of light (C, N, and O) and heavy (Ag and Br) emulsion nuclei produced by protons of the same energy were studied. An analysis of the carbon disintegrations shows that there is no significant difference in the mechanism of formation of stars containing or not containing an α particle ($R \leq 50\ \mu$). The relative admixture of Ag and Br disintegrations to those of C, N, and O nuclei chosen by the potential barrier criterion is 19%. (auth)

5894

INELASTIC SCATTERING AND ABSORPTION OF 195 ± 15 Mev π^+ MESONS BY CARBON AND LITHIUM NUCLEI. N. I. Petrov, V. G. Ivanov, and V. A. Kusakov (Joint Inst. of Nuclear Studies USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 957-65(1959) Oct. (In Russian)

Inelastic scattering and absorption of (195 ± 15) Mev π^+ mesons by carbon and lithium ions were studied with a cloud chamber in a magnetic field. The total and differential inelastic scattering cross sections and also the total cross section for exchange scattering and absorption of π^+ mesons were determined. The experimental data obtained are compared with the results of calculation of a cascade in the carbon nucleus, and it is shown that inelastic scattering of mesons can be satisfactorily described on the basis of the pair collision hypothesis. It is shown that primarily only two nucleons of the nucleus participate in the act of absorption of a (195 ± 15) Mev π^+ meson. The probability for meson capture by n,p pairs is 2 to 3 times larger in this case than the probability for capture by pairs of identical nucleons. (auth)

5895

CROSS SECTION FOR PRODUCTION OF Cm^{240} BY IRRADIATION OF Th^{232} WITH C^{12} AND C^{13} IONS. L. I. Guseva, B. F. Myasoedov, N. I. Tarantin, and K. V. Filippova. Zhur. Eksptl'. i Teoret. Fiz. 37, 973-7 (1959) Oct. (In Russian)

The dependence of the cross sections of the reactions $Th^{232}(C^{12},4n)Cm^{240}$ and $Th^{232}(C^{13},5n)Cm^{240}$ on the energy of the bombarding particles was determined by irradiating a stack of thin foils and subsequently analyzing the reaction products. The curves for the reaction cross sections have distinct peaks characteristic of reactions of evaporation of neutrons from a compound nucleus. The peak values of the cross sections for the reactions $Th^{232}(C^{12}$ 4n)Cm^{240} and $Th^{232}(C^{13}$, 5n)Cm^{240} are, respectively, 8×10^{-29} cm^2 and 1.8×10^{-29} cm^2. Comparison of the reaction cross sections obtained by bombarding thorium with the cross sections of other nuclear reactions shows that the cross section for reactions involving evaporation of neutrons does not depend on Z^2/A in a simple manner. (auth)

5896

INELASTIC INTERACTIONS BETWEEN 80 to 300 Mev π^+ MESONS AND LIGHT NUCLEI. A. G. Meshkovskii and Ya. Ya. Shalamov. Zhur. Eksptl'. i Teoret. Fiz. 37, 978-82 (1959) Oct. (In Russian)

The cross sections for inelastic interaction between π^+ mesons and a mixture of C, F, and Cl nuclei were measured for 10 values of the π^+ meson energy in the region from 80 to 300 Mev. The results are compared with curves calculated on the basis of the optical model under the assumption of a uniform distribution of the nuclear charge and a Fermi type distribution. It is shown that the experimental results satisfy the second type of distribution. The

cross sections for inelastic scattering of π^+ mesons are measured. (auth)

5897

RAYLEIGH SCATTERING AT SMALL ANGLES OF THE γ-RAYS FROM Co^{60}. S. A. Belskii and S. V. Starodubtsev (Leningrad Inst. of Physics and Tech. Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 983-90(1959) Oct. (In Russian)

The integral cross sections for Rayleigh scattering of γ rays from Co^{60} into angles between 15′ and 1°00′ and between 15′ and 2°30′ were measured for U, Pb, W, Ta, Sn, Cu, and Ni. The quadratic dependence of the Rayleigh scattering cross section on the atomic number of the scatterer predicted by the Debye-Franz theory in the small angle region is confirmed. It is shown that the experimental Rayleigh scattering cross section in the indicated angular region exceeds the theoretical cross section values and that with decrease of Z the angular dependence of the scatterir cross section becomes more pronounced than that predicted by the theory. (auth)

5898

MEASUREMENT OF THE LIFETIME OF THE FIRST EXCITED STATE OF Ne^{21}. A. G. Khabakhpashev and E. M. Tsenter. Zhur. Eksptl'. i Teoret. Fiz. 37, 991-3(1959) Oct. (In Russian)

The lifetime of the first excited level of Ne^{21} was measured with help of a 50-channel time analyzer. The measurements yielded the value $T_{1/2} = (6.2 \pm 6.2) \times 10^{-11}$ sec. A short description of the time analyzer is given. (auth)

5899

ON RADIATIVE CAPTURE OF NEUTRONS. D. F. Zaretskii. Zhur. Eksptl'. i Teoret. Fiz. 37, 1084-7 (1959) Oct. (In Russian)

An expression is derived for the partial width of radiative capture of neutrons into states which are described by the shell wave function. It is shown that in the case of s-neutrons the indicated width is proportional to the reduced neutron width for these neutrons. The relative probabilities for transition to the $2p_{1/2}$ and $2p_{3/2}$ shell states are calculated for Si^{29}, S^{33}, Ca^{41}, and Ni^{59}. The intensity ratios thus obtained are in good agreement with the experiments. (auth)

5900

γ RAYS FROM Po–O^{18} NEUTRON SOURCE. E. M. Tsenter, A. G. Khakhpashev, and I. A. Pirkin. Zhur. Eksptl'. i Teoret. Fiz. 37, 1133-4(1959) Oct. (In Russian)

The gamma spectra from a Po–O^{18} source (prepared from nitrate of Po^{210} in water enriched up to 24% by O^{18}) were studied by means of a scintillation spectrometer. The intensities were recorded up to 1.6 Mev. Gamma lines of 0.803, 0.35, and 1.38 Mev were found, and the results were verified by neutron coincidence. Gamma rays from $O^{18}(\alpha, n)Ne^{21}$ were used for determining the decay of the intermediate nucleus Ne^{22}. (R.V.J.)

5901

ON ROTATION LEVELS OF Li^7 NUCLEUS. V. I. Mamasakhlisov and T. I. Kopaleishvili (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1134-6(1959) Oct. (In Russian)

It is shown that on the basis of an α-triton model certain levels of the nucleus can be interpreted as rotational levels. The obtained mean value of the α – t distance (2.8×10^{-13} cm) exceeds the triton magnitude ($\sim 1.5 \times 10^{-13}$ cm) and does not contradict the accepted model. (R.V.J.)

5902

ENERGY LEVELS OF Tl^{206} AND Bi^{210}. L. A. Sliv and Yu. I. Kharitonov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1151-3(1959) Oct. (In Russian)

The nucleus Tl^{206} has one neutron and one proton hole. Using single sign neutron wave functions for Pb^{207} ($p_{1/2}$ is the ground state, $f_{1/2}$ is 620 kev) and proton wave functions of the Tl^{207} ($s_{1/2}$ is the ground state, $d_{3/2}$ is 350 kev), the scheme of Tl^{206} levels was plotted in zero approximation at up to 1 Mev. A series of multiplicities with their corresponding energies, spins, and parities was developed using the above data. The level spallation forces of various multiplicities were determined. The interaction with the nuclear surface and weak pair interactions of neutron and proton holes in different shells were studied. It was revealed that with any selected parameter the interactions with the surface do not spallate level doublets but transpose them into a single line. The magnitude of the transposition is a function of the energy $\hbar\omega$ of the first vibration level and the "hardness" C of Tl^{206}. It is shown that with C varying from 1000 to 1500 Mev and $\hbar\omega$ from 1 to 3 Mev the relative distances between the doublets do not vary. The scheme of Tl^{206} energy levels is plotted for 620, 350, and 0 kev. The Bi^{210} nucleus, in addition to doubly filled shells, has one neutron and one proton hole. The single sign wave function of the Pb^{209} ($g_{9/2}$) and Bi^{209} ($h_{9/2}$) ground states were used in the calculation. The multiplicities ($g_{9/2}$ and $h_{9/2}$) have 10 levels with spins I = 0 to I = 9 with negative level parities. Two variations of Bi^{210} levels are plotted. (R.V.J.)

5903

ALPHA DECAY OF Th^{229}, INTERACTIONS OF NUCLEAR LEVELS. L. L. Gol'din, G. I. Novikova, N. I. Pirogova, and E. F. Tret'yakov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1155-7(1959) Oct. (In Russian)

A magnetic α spectrometer was used in studies of Th^{229} α decay and the Ra^{225} conversion electron spectrum was studied by means of a strong-light toroidal β spectrometer using α–β coincidence schemes. The energies and transition intensities of the obtained 12 α lines are tabulated as well as forbidden factors η. (R.V.J.)

5904

ANGULAR DISTRIBUTIONS OF LONG-RANGE α PARTICLES RELATED TO THE FISSION PROCESS. N. A. Perfilov and Z. I. Solov'eva. Zhur. Eksptl'. i Teoret. Fiz. 37, 1157-9(1959) Oct. (In Russian)

Thick-layer photoplates were used in studies of U^{235} complex fission by thermal neutrons. The emulsion recorded fission events with long-range α particles in which both fragment and α-particle tracks ended in the photolayer. The tracks of all particles and angles between the α particle and fragments were calculated for 600 events. The distribution of α particles, corrections for particle escape, and angular distribution of α particles as well as fission asymmetry are in good agreement with published data. (R.V.J.)

5905

ON THE POSSIBILITIES OF INVESTIGATIONS OF THE COMPLEX NUCLEUS LEVEL FORMED IN SLOW NEUTRON INTERACTIONS WITH ISOMERS. Yu. V. Petrov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1170-2(1959) Oct. (In Russian)

Interactions of neutrons with isomers were employed to obtain data on levels in complex nuclei at high excitation energies. Slow neutron bombardments of excited-state nuclei induce a group of excitation levels distributed at ten and hundred fold higher kev than the levels induced in non-excited nuclei. The experiments provided data on level width and density variations during strong excitatio

shifts of nuclei with a given Z and A. The spins of the two groups should differ because the isomer spin and ground state spin are not identical. Data on the lifetimes, spins, parities of final and initial states, transition energies, and the ratio $\Gamma_{n'}/\Gamma_{\gamma}$ are tabulated for $_{41}Nb^{91m}$, $_{43}Tc^{97m}$, $_{47}Ag^{110m}$, $_{48}Cd^{113m}$, and $_{52}Te^{125m}$. The magnitude $\Gamma_{n'}/\Gamma_{\gamma}$ for $l = 5$ is 10^4 to 10^5 smaller than for $l = 3$. Thus, it is possible to determine the spins of compound nuclei of the above isomers by the intensities in the fast neutron reactions (n, n'). (R.V.J.)

Particle Accelerators

5906 AERE-M-521

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EXTRACTION SYSTEM FOR NIMROD. PART I. THE PICCIONI TARGET AND THE EXTRACTION MAGNET. J. W. Burren. Nov. 1959. 18p. BIS.

A Monte Carlo computer program for investigating the effect of the lip in a Piccioni extraction system is described. Results of interest for the Nimrod extraction system are given. (auth)

5907 CERN-59-36

European Organization for Nuclear Research, Geneva.

ETUDE DU MOVEMENT D'UN OSCILLATEUR ANHARMONIQUE SOUS L'ACTION D'UNE FORCE SINUSOIDALE, DE FREQUENCE VARIABLE, AU VOISINAGE DE LA RESONANCE PRINCIPALE. (Study of the Motion of an Anharmonic Oscillator Under the Action of a Sinusoidal Force, of Variable Frequency, near the Principal Resonance). M. Barbier and B. V. Robouch. Nov. 1959. 49p.

A study of non-linear oscillators is described which made possible the establishment of the space distribution of phases at the resonance of points corresponding to a given amplitude remote from this resonance and for a deviation direction of given frequency. An atlas of curves defining these distributions for different initial amplitudes and perturbations was obtained. An evaluation was made of the beam fraction whose oscillation amplitude does not exceed the initial amplitude after undergoing perturbation in the course of a given passage. It was supposed that in all the calculations there was a uniform particle distribution in the phase-space before application of the perturbation and that the first approximation of the Liouville theorem was valid for the area of the contours which in fact do not correspond to a movement of the arrangement itself; the results are presented graphically. The beam fraction susceptible to entrainment beginning with the resonance was studied as a function of the perturbation for different dimensions of the initial beam. (T.R.H.)

5908 DESY-A-2.52

Deutsches Elektronen-Synchrotron, Hamburg.

BEEINFLUSSUNG VON TEILCHENBAHNEN DURCH HOMOGENE ABLENKFELDER (f-TYP-STÖRUNGEN). (Control of Particle Orbits by Homogeneous Deflection Fields (f-Type Perturbations). F. Brasse and K. G. Steffen. Nov. 17, 1959. 15p.

A mathematical treatment of the use of homogeneous deflection fields is presented. The particle orbits for these deflection fields were produced by phase and amplitude functions in closed form. The equations given make a simple numerical solution possible. The general equations are given and developed in sections on constant time deflection field, slowly increasing deflection field, high-frequency deflection field with constant frequency, and high-frequency deflection field with linearly variable frequency. (T.R.H.)

5909 MURA-531

Midwestern Universities Research Assn., Madison, Wis.

USE OF AN ELECTROLYTIC TANK. C. D. Curtis and R. E. Rothe. Nov. 9, 1959. 15p. Contract AT(11-1)-384. OTS.

A brief review of electrolytic tank principles is followed by a discussion of some specific applications. Emphasized are the techniques, sources of error, and reliability of measurements which existed in the design of electrodes for a Pierce-type electron gun. (auth)

5910 UCRL-8929

California. Univ., Berkeley. Lawrence Radiation Lab.

A RADIOFREQUENCY SEPARATOR FOR HIGH-ENERGY PARTICLES. Myron L. Good. Oct. 28, 1959. 19p. Contract W-7405-eng-48. OTS.

A preliminary version of the r-f separation scheme outlined was given at the MURA Users' Conference of June 1959. At that conference the group on beam separators discussed the problem of whether particle separation could be achieved at the machine energies under consideration. The scheme described has an over-all acceptance (at 10 Bev/c) comparable to Bevatron separated beams (at 1 Bev/c). It would seem to be applicable to the BNL AGS and the Cern and ANL accelerators as well. The separation of π and K mesons is considered. (W.D.M.)

5911

BETATRON ENERGY CALIBRATION. L. Katz (Univ. of Saskatchewan, Saskatoon). Can. J. Phys. 37, 1455-64(1959) Dec.

A betatron energy controlling circuit is described. It is shown that there is a linear relationship between the helipot control on this circuit and the momentum of the electrons in the betatron just prior to striking the x-ray producing target. It is also shown that photoneutron thresholds can be used to calibrate the betatron energy scale with good internal consistency. (auth)

5912

PHASE MOTION IN A SYNCHRONOUS ACCELERATOR WITH TILTED ACCELERATING GAP. Richard Klíma (Research Inst. of Vacuum Electronics, Prague). Czechoslov. J. Phys. 8, 404-10(1958). (In English)

A theory of phase motion in a synchronous circular accelerator is derived for the case that, in addition to the accelerating component of a high-frequency field, a component acts on a particle which deforms the path of the particle. For an accelerator with constant period of revolution and fixed magnetic field, the result is asymptotic focusing of the particles to a certain phase Ψ_s. (auth)

5913

AN ACCELERATOR WITH A HELICAL FIELD. Jiří Teichman (Vacuum Electronics, Prague). Czechoslov. J. Phys. 9, 262-3(1959). (In English)

A method of forming a guiding and focusing field for an accelerator with vertical field growth is presented. The guiding magnetic field is continuous and is azimuthally modulated by magnetic "inhomogeneities" which described a helix on a cylinder on a helical spiral on another rotation field. The exponential growth of the field with vertical coordinates ensures the constancy of the frequencies of the betatron oscillations. The equilibrium orbit is also waved with radial and vertical amplitudes. (J.S.R.)

5914

AN ELECTRON GENERATOR FOR RADIOCHEMICAL

USE. Manfred von Ardenne (Forschungsinstitut. Manfred von Ardeene, Dresden-Weisser Hirsch, Ger.). Jaderná energie 5, 345-8(1959). (In Czech.)

A 2 Mev Van de Graaff electron generator for laboratory use is described. More detailed descriptions of universal ion and electron sources and of graphical determination of doses in various irradiation experiments are given. (auth)

5915

THE TUNINGFORK FREQUENCY MODULATOR OF THE CERN SYNCHRO-CYCLOTRON. I. GENERAL DESIGN. Frank Krienen (European Council for Nuclear Research, Geneva). Nuclear Instr. and Methods 5, 280-91(1959) Nov. (In English)

This report deals with the design of the tuning fork modulator for the 600 Mev Synchrocyclotron, which accelerator came into operation for the first time in August 1957. The intricate position of the modulator in the accelerator as a whole, required the development of the principle of scaling. Basic design considerations were put forward. These considerations have initiated an experimental program, which in its turn verified and corrected the starting point. Suitable mechanical and electrical analogs were derived, which in many respects clarify the nature of the problem. The control and initial operation of the system were described and possible improvements are mentioned. The report as such is drawn up from author's unpublished divisional reports, engineering notes, and communications with contractors. (auth)

5916

THE TUNINGFORK FREQUENCY MODULATOR OF THE CERN SYNCHRO-CYCLOTRON. II. MECHANICS OF TUNINGFORK. Frank Krienen (European Council for Nuclear Research, Geneva). Nuclear Instr. and Methods 5, 292-9(1959) Nov. (In English)

An analysis is given of the motion of a tuningfork, whose prongs are tapered. A suitable expression for the resonance frequency and the stresses in the material has been obtained, in fair agreement with experiment. The application of aluminum was shown to be not inferior to steel. An expression for the longitudinal motion, important for the driving system, was obtained. The higher modes of vibration are discussed qualitatively together with the possible effects on the performance. (auth)

5917

STARTING UP OF THE CYCLOTRON WITH SPACE VARIATION OF THE MAGNETIC FIELD. V. I. Danilov, Yu. N. Denisov, V. P. Dmitrievskii (Dmitrievsky), V. P. Dzhelepov, A. A. Glazov, V. V. Kolga, A. A. Kropin, Lu Ne-Chuan, V. S. Rybalko, L. A. Sarkisyan, A. L. Savenkov, D. P. Vasilevskaya, B. I. Zamolodchikov, and N. L. Zaplatin (Joint Inst. for Nuclear Research, Dubna, USSR). Nuclear Instr. and Methods 5, 335-6(1959) Nov. (In English)

The mean magnetic field increase along the radius in accordance with relativistic mass increase of the accelerating ions is discussed. The magnetic field increase is necessary for the elimination of non-linear resonance effects at the center of the accelerator. Measurements of the magnetic field were made with an accuracy of ±1.5 gauss by a nuclear magnetometer. Deuterons were accelerated to an energy of 12 Mev and α particles of 24 Mev when the minimum amplitude of the accelerating voltage on the dee was 8 kv. All measurements were carried out with the intensity of the internal beam close to 1 μa. (B.O.G.)

5918

WITHDRAWAL OF A BEAM OF ACCELERATED ELECTRONS OUT OF THE CHAMBER OF A CYCLICAL ACCELERATOR WITHOUT THE APPLICATION OF A LEAD-OUT DEVICE. A. A. Vorobjev and L. S. Sokolov (Polytechnical Inst., Tomsk, USSR). Nuclear Instr. and Methods 5, 337-8(1959) Nov. (In English)

The withdrawal of an electron beam from the chamber of a betatron or synchrotron is founded on the removal of electrons out of the working zone in two stages: the translation of the orbit and the withdrawal of the electrons. An equation for the movement of the electron with due regard for the non-linear focusing-force as deviation size relation is presented and solved. A beam of electrons with 10-Mev energy, an efficiency of 75%, and an average current of 6×10^{-10} a was led out of the betatron. The dimensions of the beam at the lead-out window were 4 × 60 mm, and 20 × 90 mm at a distance of 10 cm from the window. (B.O.G.)

5919

NEW ELECTROSTATIC ACCELERATOR. Irving Michael, E. D. Berners, F. J. Eppling, D. J. Knecht, L. C. Northcliffe, and R. G. Herb (Univ. of Wisconsin, Madison). Rev. Sci. Instr. 30, 855-63(1959) Oct.

A new electrostatic accelerator was constructed and tested. The entire vacuum system including the accelerating tube and ion source is of bakable construction. The accelerating tube, corona tube, and support column are constructed of thin metal disks hard-soldered to alumina ceramic rings and the insulation length of each is 5 ft. Without the accelerating tube the generator was operated at potentials in excess of 7 Mv corresponding to gradients of over 1400 kv/ft. With flat disk molybdenum electrodes usable voltage was limited to 2.1 Mv. When these electrodes were replaced by flat disk steel electrodes having smaller beam apertures and provided with side pumpout holes, the accelerator was operated for short times at potentials in excess of 4 Mv corresponding to a tube gradient of over 800 kv/ft. There was no evidence of small discharges or electron loading in the tube. During the course of these tests three tube ceramics were cracked—probably by sparking—and it is now difficult to operate the machine at potentials much above 3.5 Mv. Voltage division is accomplished by a series of negative point-to-plane corona gaps which are enclosed in a tube. The charging belt is equipped with paper staples which are charged by induction. Accelerator voltage is very stable. (auth)

5920

TWOFOLD PULSING OF VAN DE GRAAFF BEAMS FOR TIME-OF-FLIGHT MEASUREMENTS. H. W. Lewis, P. R. Bevington, W. W. Rolland, R. L. Rummel, and R. M. Wilenzick (Duke Univ., Durham, N. C.). Rev. Sci. Instr. 30, 923-4(1959) Oct.

A system was developed which combines pre- and post-acceleration pulsing of the beam from a Van de Graaff accelerator. It has the advantages of low belt charge for a given target current, low background at the detector, and high time resolution. The internal pulser operates at a frequency of 5 Mc and produces bursts 5 to 10 mμsec long. The external pulser is driven sinusoidally by amplifying the pulses from a pickup loop with a tuned 5-Mc amplifier containing a phase shifter. Synchronization can be accomplished with peak beam currents at the pickup loop as small as 10 μa. The sinusoidal signal at the external pulser is used as the timing reference signal to a Los Alamos time-to-pulse height converter. The burst duration at the target is determined by the amplitude of the sweep voltage applied to the external pulser. (auth)

5921
ACCELERATION OF POLARIZED PROTONS WITH STRONG-FOCUSING LINEAR ACCELERATORS. David Cohen and Alan J. Burger (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 30, 1134-5(1959) Dec.

Calculations are presented on the amount of depolarization of source-polarized protons during acceleration in a 50-Mev injector linac. Of the 124 magnets, having six orbits, the six orbits denoted largest allowable radial motions in the ++—— mode of magnet rotations. Two orbits were in the initially-focusing plane, two were in the initially-defocusing plane, and two were mixed. Calculations revealed that the proton movement never deviated by more than 10° from the direction at injection in any of the six orbits. (C.J.G.)

Plasma Physics and Thermonuclear Processes

5922 AD-216015
Uppsala Univ.
RESEARCH IN HIGH TEMPERATURE PLASMA PHYSICS. Technical Status Report No. 1 [for] October 1, 1958 through December 31, 1958. Per Ohlin and Kai Siegbahn. 4p. Contract AF61(052)-170.

Work is carried on with three different set-ups: a straight discharge tube, a small toroid, and a large toroid. Investigations with the three set-ups are briefly summarized and plans for the next quarter are discussed. (W.D.M.)

5923 AERE-L-104
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
LECTURES ON THE HYDROMAGNETIC STABILITY OF A CYLINDRICAL PLASMA. III. SURFACE INSTABILITIES OF THE "STABILISED PINCH." R. J. Tayler. Aug. 1959. 28p. BIS.

The simplest stable configuration of a cylindrical discharge is that known as the "stabilized pinch." This is a configuration in which all the currents flow on the surface of the plasma and there are two stabilizing influences; a strong axial magnetic field inside the plasma and a conducting tube containing the system. This configuration is physically unreal as any current layer must have a finite thickness. When such a thickness is introduced, perturbations are possible which disturb the surface of the plasma but do not affect the inner surface of the current layer. The trapped axial magnetic field cannot exert its full stabilizing influence on such perturbations and the conditions for stability are more stringent than those required for the "stabilized pinch." Stable configurations do exist in which the axial magnetic field in the vacuum is in the opposite direction to the axial magnetic field in the plasma. (auth)

5924 AFOSR-TR-59-170
Litton Industries. Space Research Labs., Beverly Hills, Calif.
RESEARCH STUDY ON PLASMA ACCELERATION. Final Report. G. Fonda-Bonardi. Sept. 30, 1959. 73p. Contract AF49(638)-345.

A summary of the principles of operation, design criteria, construction details, and instrumentation of a pulsed plasma accelerator is given. The purpose of the project was twofold: to provide verification of the theory previously developed, and to supply engineering information and design data for further applications of the principles involved. Preliminary experimental results are described which appear to substantiate the theoretical predictions; further experimental development is warranted and is expected to be carried out at a later time. A preliminary study of an application of the plasma accelerator to high specific impulse thrust production for propulsion purposes is described. It appears that a favorable efficiency can be obtained. A bibliography on pertinent magnetohydrodynamics research and related subjects is appended. (auth)

5925 ORNL-2802
Oak Ridge National Lab., Tenn.
THERMONUCLEAR PROJECT SEMIANNUAL REPORT FOR PERIOD ENDING JULY 31, 1959. Dec. 30, 1959. 140p. Contract W-7405-eng-26. OTS.

In respect to DCX, perhaps the greatest single advance has been an appreciation of the importance of the vacuum carbon arc as a loss mechanism (by charge exchange) for the trapped H^+ plasma. Loss in the arc and dissociation efficiency are both sensitive to electrode configuration; with the anode and its baffle assembly at the center of the anode-end mirror coil, the arc provides by far the most important loss mechanism. With the anode and its baffle retracted about 10 in. so that they are at the outer face of the anode-end mirror coil, conditions are much better: the mean residence time of the trapped ions is lengthened by a factor of 5, and the arc loss is then approximately equal to the loss by charge exchange in the residual gas at a pressure of 10^{-6} mm Hg. Under the condition of greater loss, the arc is presumably dense and is probably populated largely with C^+ and C^{2+} ions; the molecular dissociation efficiency is about 30% for a single pass of the 600-kev H_2^+ beam. When loss is reduced by retraction of the anode and its baffle, the arc is probably less dense and may be populated mostly by C^{3+} and C^{4+} ions, but the dissociation efficiency is reduced to 8%. It should perhaps be remarked that the arc loss being observed is not in conflict with the limit set two years or more ago, namely, that fewer than 1 in 10^5 of the 300-kev H^+ ions that pass through the arc suffer a charge exchange therein; the loss now seen is just about at that limit. Clearly, the arc loss must be removed from DCX; there is little to be gained by striving for better vacuums while it is present. Progress might be gained by moving the electrodes farther in the direction that has already been found to be favorable; this would require a lengthwise extension of the magnetic field of DCX. A more promising approach appears to be the introduction of orbital precession such that the trapped H^+ ions pass through the arc only in every tenth to twentieth orbital circuit. Not only would this reduce charge-exchange loss in the arc, but it would also reduce scattering and energy loss. This will be one of the first modifications to be tried (since it involves a simpler physical change), even though it promises a more modest gain than does moving the electrodes. A third possibility is to go to the hydrogen or deuterium arc, where the charge exchange should be zero; the technical problems appear, however, to be severe, and experience with deuterium arcs will first be accumulated in the PPF and DCX-EPA apparatus. In auxiliary experimentation, a noteworthy advance was made in knowledge of the secondary plasma that surrounds the column of a vacuum carbon arc. Experiments by molecular ion dissociation, microwave absorption, and ion extraction agree in giving information about the radial decrease in density. The rather substantial fringing ion population may be simply the result of ambipolar diffusion outward from the column. The sideways momentum imparted to metallic granules when they

are dropped into a vacuum carbon arc was measured and found to be roughly compatible with carbon ion densities and velocities that have been inferred from other work, that is, a peripheral rotational velocity of 3×10^5 cm/sec and a density of 10^{14} cm^{-3}. A vacuum carbon arc was run at a record low for the ambient pressure, namely, 5×10^{-8} mm Hg. Previously, the lowest ambient pressures had been 2×10^{-7} mm Hg. Development of the large, hollow cylindrical arcs continued; D_2^+ ions at 30 kev were injected into them, and a wrap-up of dissociated D^+ ions was visually observed in the interior; again, in these first attempts, the wrap-up was produced only for a brief interval, but the accomplishment was established nevertheless. The duoplasmatron ion source was developed to the point of yielding 100 ma of ions at 70 kev. An algebraic theory of burnout in an OGRA-like machine was developed which gives numerical results for OGRA itself that agree with those of the Russians, but the functional dependence of relevant quantities is found to be different. The research engineering in the Project was particularly active, in the design of magnetic fields in apparatus to be built, in the calculation of orbit trajectories therein, and also in the testing of vacuum components. A substantial effort in mechanical and construction engineering was required for the impending move of the Project to new quarters. The design of a new DCX apparatus (DCX-2) remains conceptual, but a magnetic field configuration was developed that promises a large volume of uniform field in a flexible arrangement permitting injection and accumulation experiments that are impossible in DCX-1. (For preceding period see ORNL-2693.) (auth)

5926 ORNL-2880

Oak Ridge National Lab., Tenn.

KINETIC EQUATIONS FOR PLASMA AND RADIATION. Albert Simon and E. G. Harris. Jan. 21, 1960. 36p. Contract W-7405-eng-26. OTS.

The starting point is the Liouville equation for the density in phase space of a system of charged particles and a denumerably infinite set of field oscillators. By integrating out the coordinates of all but a finite number of particles and oscillators one obtains a chain of equations relating the reduced distribution functions. A complete solution to the chain is obtained by a generalization of the expansion method of Rosenbluth and Rostoker. In lowest order one obtains a coupled set of self-consistent field equations in the one-particle and one-oscillator distributions. These are partially decoupled to give the usual Vlasov equation and a companion equation for the oscillator distribution. In first order one obtains a similar set of equations for the two-particle and the particle-oscillator correlation functions. An entirely similar pair of equations then relates the first-order distribution functions themselves. It appears that the general solution is obtained by the steady unfolding of higher correlation functions in terms of higher and higher self-consistent field equations. The first order equations can be regarded as a "Fokker-Planck" equation for particles and a "Fokker-Planck" equation for radiation. (auth)

5927 PIBAL-371

Brooklyn. Polytechnic Inst.

ENERGY EXPRESSIONS AND DIFFERENTIAL EQUATIONS FOR STRESS AND DISPLACEMENT ANALYSES OF ARBITRARY CYLINDRICAL SHELLS. Joseph Kempner. Apr. 1957. 42p. Project No. NR-064-167. Contract Nonr-839(14).

Energy expressions and the related equilibrium equations and natural boundary conditions for the determination of the stresses in and displacements of uniform, thin-walled cylinders of arbitrary cross section loaded in an arbitrary manner by surface and edge forces and moments are presented. The derivations are based upon the Kirchhoff-Love assumptions of the classical theory of shells and are performed to within a degree of accuracy employed by Flügge in his derivation of the equilibrium equations applicable to circular cylindrical shells; hence, in terms of stress resultants, the exact, small-deflection equilibrium equations are obtained. Methods of simplification of the relations derived and of solution of the differential equations presented are indicated. (auth)

5928 TP-64

[United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England].

INTRODUCTION TO PLASMA PHYSICS 4—MAGNETO HYDRODYNAMICS II. [1957?]. 10p.

Little is known about the general properties of solutions to the magnetohydrodynamic equations, even for idealized cases; however, a few important special solutions are known, and the generalizations of the theory of sound have been made. General properties, particular solutions for incompressible flow, compressible flow (magnetosonic waves), and shocks are considered. (W.D.M.)

5929 UCRL-5689

California. Univ., Livermore. Lawrence Radiation Lab.

THE HIGH-ENERGY ELECTROSTATIC PLASMA GUN. Raymond Fox. Nov. 3, 1959. 45p. Contract W-7405-eng-48. OTS.

The source, acceleration, and neutralization of the ions for an electrostatic plasma gun are analyzed. Relations are derived for the evaluation of (1) the formation of low energy ions due to charge exchange and electron ionizing collisions, (2) space charge build-up, (3) electron energy losses, (4) electron-ion recombination, and (5) mean free path for electron-ion collisions. A design is presented which minimizes most of the problems associated with the electrostatic plasma gun. The ion source faces a high electric field which allows for high ion current densities. The electron source supplies a sufficient number of electrons for space charge neutralization. The geometry of neutralization ensures small space charge build-up. An electron potential hill about the ion source prevents electrons from being accelerated to the positive electrode. The power loss due to space charge neutralization is minimized by an external electrode. The geometry is such that the ions are not near any electrode after leaving the ion source. This results in negligible sputtering. The field lines go out into space and then curve back. At the position at which the field lines start to curve back, the ions have almost their full energy and are virtually unaffected. The design appears to be very promising. (auth)

5930 UCRL-8885

California. Univ., Berkeley. Lawrence Radiation Lab.

EXPERIMENTAL STUDY OF PLASMA ALFVÉN-WAVE PROPERTIES. John M. Wilcox, Forrest I. Boley, and Alan W. De Silva. Aug. 27, 1959. 21p. Contract W-7405-eng-48. OTS.

Alfvén hydromagnetic waves are propagated through a cylindrical plasma. The wave velocity, attenuation, impedance, and energy transfer are studied. The theoretical equations predict correctly the functional dependence of the velocity and attenuation, and from these quantities accurate measurements of plasma density and temperature can be obtained. A qualitative agreement between theory and experiment is obtained for the hydromagnetic coaxial

waveguide impedance, and the energy transferred from an oscillating circuit to the hydromagnetic wave is measured to be 43 ± 10%. (auth)

5931 ZPh-044

Convair, San Diego, Calif.

MOTION OF THIN BODIES IN A HIGHLY RAREFIED PLASMA. H. Yoshihara. Sept. 22, 1959. 15p. Contract AF(604)-554.

The motion of a thin body in a highly rarefied plasma is considered where: magnetic effects are negligible and the velocity of the body is in a range between the electron and positive ion thermal speeds. The self-consistent field approach is used in which the electron distribution is assumed to be Maxwellian, while the positive ion distribution function is given by the "collision-free" Boltzmann equation. It is assumed that: the ion reflection at the body surface is specular, and the body is sufficiently thin so that the ion distribution function is a small perturbation of a Maxwellian distribution. The ion disturbance distribution function is then given as a sum of two parts. The first part is identical to the scattering arising in the free molecule flow of neutral particles with specular reflection, while the second part represents the usual collective motion arising in rarefied plasmas. For the latter portion a "fluid" equation is derived which is valid for body velocities very much larger than the ion thermal speed and for negligible Landau damping. The solution for the simple case of a dielectric body with a given surface charge is described, as well as some general properties to be expected for a conducting body. (auth)

5932 AEC-tr-3942

SOME CHARACTERISTICS OF INDUCTION GAS DISCHARGE. E. D. Andriukhina, S. E. Grebenshchikov, M. S. Rabinovich, M. D. Raizer, A. Ya. Safronov, and I. S. Shpigel'. Translated by Lydia Venters (Argonne National Lab.) from a paper presented at the Fourth International Conference on Ionization Phenomena in Gases in Uppsala, Sweden, August 1959. 15p. JCL or LC.

Experiments are described which were set up to investigate the phenomena of capture magnetic flux, clarify the identity of the disposition of the current and luminescence, detect the presence of the skin-effect, and establish the role of shock waves in induction discharges in a large frequency range. The experiments were carried out in axially-symmetric homogeneous and inhomogeneous magnetic fields with the ratio between the induction plasma resistance and the active one $wL/R \sim 1$ and $wL/R \gg 1$. To produce a variable magnetic field, the oscillatory discharge of a battery of condensers into the inductance of the magnetic system was used. (W.D.M.)

5933 CEA-tr-A-458

ETUDE DES GAZ IONISÉS À L'AIDE DE FAIBLES CHAMPS ÉLECTRIQUES ALTERNATIFS. (Study of Ionized Gases Using Weak Alternating Electric Fields). Angelika (Angelica) Szekely. Translated into French from Acta Phys. Austriaca 12, 91-107(1958). 22p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13229.

5934

MEASUREMENT OF ELECTRON CONCENTRATION OF PLASMA IN TOROIDAL RESONATOR. Miloš Šícha and Vítězslav Veselý (Karlov Univ., Prague). Czechoslov. J. Phys. 8, 256-7(1958). (In Russian)

Electron concentrations in plasma were measured by a high-frequency probe method in a special installation using a toroidal resonator. The results are tabulated and compared. In the high-frequency method, there is practically no influence on the discharge, measurements can be taken at any point in the discharge tube, and measurements may be made at pressures below 22 mm Hg when $\sigma < \epsilon_0\omega_{rez}$. The disadvantage of the method is the large area of interactions for discharge tube diameters larger than 1 cm. (R.V.J.)

5935

THE TIME DEPENDENCE OF THE TEMPERATURE OF AN ELECTRON OF A LOW PRESSURE DISCHARGE FOR A CHANGE IN THE VOLTAGE OF THE SOURCE. Jirí Kracík (Electrotechnical Faculty, Prague). Czechoslov. J. Phys. 8, 341-8(1958). (In English)

If a variable periodic or non-periodic electric current passes through a gas discharge there is a certain phase difference between this current and the corresponding voltage on the electrodes. The magnitude of this phase difference is dependent both on the conditions existing inside the discharge and on the external electric circuit. It is obvious that apart from the shape of the tube and the type and pressure of the neutral gas, the behavior of the discharge will be determined by the concentration and temperature of the electrons and by the following external conditions: the voltage of the source and the character of its dependence, and the stabilizing resistance or impedance. A theoretical study is made of the change in temperature and concentration of electrons at a glow discharge, stabilized by ohmic resistance, as a function of the change in voltage of the source. (auth)

5936

LOCAL EXCITATION OF THE WAVE OF STRATIFICATION IN THE POSITIVE COLUMN OF AN ELECTRIC DISCHARGE. Luděk Pekárek (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 498-9(1958). (In English)

A stratification wave was excited by weak square-wave modulation of the discharge current using a pentode, and by a very short voltage pulse applied to the external electrode near the cathode. A narrow metal ring was placed outside a discharge tube. Pulses of 1 μsec were applied to the ring, and oscillographs of the light intensity in the positive column excited by striation motion were made. The experiment indicated that a stratification wave can originate any place in an originally homogeneous positive column if the stationary state of the processes in the plasma is externally perturbed in this place, independently of the boundary regions of the discharge. (T.R.H.)

5937

THE INFLUENCE OF THE CATHODE REGION ON THE DYNAMIC PROPERTIES OF A GLOW DISCHARGE IN HYDROGEN. Václav Krejčí (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 689-98(1958). (In Russian)

Short voltage pulses were applied to a glow discharge in spectrally pure hydrogen, maintained by direct current. These pulses brought the discharge into a non-stationary state. The return to the stationary state is brought about by a stabilizing process which caused changes in the voltage at the discharge, which were depicted on an oscillograph. At pressures of 0.3 to 1.5 mm Hg the stabilizing process had the form of periodically damped oscillations. The frequency of these oscillations was measured as a function of different parameters, including the capacity of the condenser C_x, connected in parallel to the discharge. The results of this measurement are shown on oscillograms. For higher values of the capacity C_x and lower pressures these curves differ from analogous dependences found in inert gases. By measuring the same de-

pendences for different surfaces of the cathode it was found that the different course of the curves in hydrogen is caused by the influence of the energies amassed in the cathode region of the discharge. In order to clarify the measured dependences an equivalent circuit was proposed, composed of three parts: an equivalent circuit of the positive column of the discharge (elements R_s, L_s, and C_s), of the cathode region (L_k, R_k, and C_k) and of the external circuit (R_v and C_v). The elements L_s, C_s, L_k, and C_k represent different stores of energy in the discharge. Basic equations were constructed for the voltages and currents in this circuit and solved for initial conditions. Laplace-Carson transformations were used for the solution. The resultant course of the voltages in the discharge is in qualitative agreement with the course found oscillographically. An approximate expression was also calculated for the constant b, determining the frequency of the oscillations produced and for the quantity da/dC_v, which according to the results of measurement should be positive. By substituting the order-of-magnitude constants of the equivalent circuit into the calculated relations we found order-of-magnitude agreement with the results of measurements. (auth)

5938

THE SUCCESSIVE PRODUCTION OF STRIATIONS IN A GLOW DISCHARGE IN HYDROGEN. Luděk Pekárek (Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 699-704(1958). (In English)

The manner of successive production of striations moving from the cathode to the anode in a glow discharge in hydrogen is experimentally investigated. For this purpose use is made of the method of an artificially produced transient process in the positive column. It is shown that the fundamental phenomenon in the production of these striations, similarly as with an inert gas, is the wave of stratification. The wave of stratification in hydrogen, however, differs from that in the plasma of an inert gas in the direction of motion of the striations. This direction in a hydrogen discharge is the same as the direction of the successive production of striations, i.e., from cathode to anode. The phenomenological theory of the successive production of moving striations elaborated earlier is also applicable for the wave of stratification in hydrogen. (auth)

5939

CHANNEL OF SHORT-TIME HIGH-INTENSITY ELECTRIC DISCHARGE. Vladimír Hermoch (Inst. of Mechanical Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 377-87(1959). (In Russian)

By the spatial expansion of the radial cross-section of the channel of the given type of discharge (duration of 10^2 sec and maximum intensity smaller than 10^4 amp) and by measuring some of its electrical quantities, information was obtained on its channel and the influences causing the formation process. (auth)

5940

A NEW TYPE OF MOVING STRIATIONS IN NEON. Luděk Pekárek and Miloš Novák (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 401-2(1959). (In German)

In a systematic remeasurement of the fast and slow striation waves in neon, a third type of striation wave was detected. Its propagation velocity and motion velocity are greater than that of the previously known fast wave. With increasing current intensity, the motion velocity of the two fast waves decrease, and the periods increase slightly. The values of the energy, periods, and velocity are tabulated for currents of 2.6 mamp. (J.S.R.)

5941

THE INFLUENCE OF A STRONG HIGH-FREQUENCY FIELD ON THE STRATIFICATION OF THE POSITIVE COLUMN OF A D-C GLOW DISCHARGE. Miloš Šícha (Charles Univ., Prague). Czechoslov. J. Phys. 9, 495-504(1959). (In Russian)

An experimental study is made of the damping of moving striations in a d-c glow discharge by a strong high-frequency field. The results of measurement are in agreement with existing conceptions on the production and mechanism of propagation of moving striations. Apart from the process of damping the paper also describes the standing stratification of the positive column of a d-c discharge as a result of a superposed high-frequency discharge. (auth)

5942

ON PROCESSES IN ELECTRODE SPACES OF SHORT-TIME HIGH-INTENSITY ELECTRIC DISCHARGES. Vladimír Hermoch (Inst. of Technical Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 505-11(1959). (In Russian)

The conditions and causes of the interrupted emission of the vapors of the material of short-time high-intensity electric discharge electrodes are discussed on the basis of earlier and new observations. (auth)

5943

DETERMINATION OF ATOMIC CONCENTRATION IN ARC DISCHARGE PLASMA ACCORDING TO THE SPECTRAL LINE WIDTHS AND THE BOND BETWEEN CONCENTRATIONS IN SOLID AND GAS PHASES. I. M. Nagibina (Leningrad Inst. of Precision Mechanics and Optics). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1056-9(1959) Sept. (In Russian)

Measurements were made of mean concentrations of atoms and ions in the cloud of an a-c arc discharge, with consideration for the degree of non-uniformity of the source i.e., the irregularity of the excited and unexcited atoms along the discharge cross section. The measurements indicate a direct proportionality between atomic and ionic concentrations of Mg and Ca in discharge clouds and in prepared electrodes. (R.V.J.)

5944

ON THE CHARACTERISTICS OF ARC DISCHARGE IN THE ATMOSPHERE OF CERTAIN GASES. V. L. Marzuvanov. Invest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1059-61(1959) Sept. (In Russian)

Characteristics of d-c arc discharge (power, spectra, electrode temperature, rate of element evaporation, etc.) in atmospheres of helium, argon, air, nitrogen, chlorine, and carbon dioxide were studied. (R.V.J.)

5945

THE ENTRANCE OF SUBSTANCE INTO ARC PLASMA. THE CASE OF Na AND Li BINARY MIXTURES. V. P. Zakharov and A. A. Shishlovskiĭ. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 23, 1063-4(1959) Sept. (In Russian)

The influence of electrode composition on the entrance of substance into d-c arc plasma is studied using NaCl, Na_2CO_3, and Li_2CO_3 mixed with carbon and placed into a carbon electrode. The yellow Na doublet and red Li line 6708A are used in establishing the relationship between electrode and discharge contents of lithium and sodium. (R.V.J.)

5946

PROPAGATION CHARACTERISTICS OF DETONATION-GENERATED PLASMAS. Melvin A. Cook, Robert T. Keyes, and Lex L. Udy (Univ. of Utah, Salt Lake City). J. Appl. Phys. 30, 1881-92(1959) Dec.

Studies are presented showing the electrical properties of the highly ionized, detonation-generated plasmas ejected into various gaseous media at the bare surfaces of high explosives. These eternal plasmas are shown to originate from chemionization in the reactions of high explosive at free surfaces and are not produced by thermal ionization in the shock wave propagated in the surrounding gaseous medium. The initial external-plasma length L_p^* was found to be directly proportional to the length a_0 of the reaction zone of the high explosive-generating source. Conduction measurements in plasmas propagating in chlorine, oxygen, argon, nitrogen, helium, and air showed that the electron affinity of the gaseous medium is important in determining the rate of decay of the plasma and its ultimate disintegration. The lifetime of external plasmas are substantial in media of low electron affinity, exceeding appreciably 250 μsec in such media as argon, helium, and nitrogen. Free electrons contribute practically the entire conductivity of these plasmas. Interesting pulsations occur when the external plasmas are generated by a charge of diameter smaller than the constraining tube and upon passing from a smaller into a larger constraining tube. A striking confirmation of the quasi-lattice or metallic-like model of plasmas is the observation that the plasma finally "explodes" into a gas cloud many times larger when its ion density decays to a critical low level. (auth)

5947

ASYMMETRICAL TRIPLE PROBE METHOD FOR DETERMINING ENERGY DISTRIBUTION OF ELECTRON IN PLASMA. Takayoshi Okuda and Kenzo Yamamoto (Nagoya Univ., Japan). J. Appl. Phys. 31, 158-62(1960) Jan.

A new probe method is proposed. This method is an improvement of the floating triple probe method, which was proposed in a previous paper. In this method, the dimension of one operating probe is different from the other, so that the smaller probe behaves as the single probe. Thus, the measurable range of electron energy can be extended as much as that in the single probe method. The asymmetrical triple probe and double probe methods are verified experimentally. The asymmetrical triple probe method has a merit that a disturbance, which is inevitable in the single probe method, can be eliminated in this method. The electron energy distribution obtained by the new probe method is not always in accord with that obtained by the usual single probe method. The hump often observed at high energy range in the single probe method does not appear in the new method, illustrating that the latter is free from erroneous estimation due to the disturbance. (auth)

5948

CONTINUOUS EMISSION OF HYDROGEN PLASMAS. Frithjof Mastrup (U. S. Army Engineer Research and Development Labs., Fort Belvoir, Va.). J. Opt. Soc. Am. 50, 32-5(1960) Jan.

The continuous absorption coefficients for the bound-free and free-free transitions of H and H^- as well as the total absorption coefficients are given for hydrogen plasmas of 1, 10, 30, 100, and 300 atmos pressure and temperatures of 10,080, 12,600, and 16,800°K in the wavelength range from 2000 to 40,000 A. In order to calculate the free-free transitions of H^-, the tables of Chandrasekhar and Breen were extended to include $\theta = 0.4$ and $\theta = 0.3$. The results of these calculations, namely the free-free absorption coefficients for H^- per neutral hydrogen atom in the ground state and unit electron pressure, are given for $\theta = 0.4$ and $\theta = 0.3$. Finally, from the total absorption coefficients, the continuous emission from a 1-cm thick layer of the hydrogen plasmas under consideration was derived. It is shown that for certain temperatures and pressures the continuous emission becomes so strong that the blackbody intensity of the corresponding temperature is reached for all wavelengths under consideration. This makes the plasma, in particular, useful for photolysis work and absorption spectroscopy. (auth)

5949

SPECTROSCOPIC INVESTIGATION OF HYDROGEN PLASMA PRODUCED BY AN IMPULSIVE DISCHARGE. Manabu Yamamoto (Hitachi Central Research Lab., Tokyo). J. Phys. Soc. Japan 14, 1739-46(1959) Dec. (In English)

Time variation of the radiation intensity was observed during an impulsive discharge through hydrogen gas. Oscillogram traces of the intensity of the Balmer lines and continuum are shown, and the temperature dependence of the spectral intensity is discussed. Temperature of the plasma at various phases of the discharge current is deduced from the time variation of the radiation intensity, from spectral energy distribution of the Balmer continuum, and from electrical conductivity. It is shown that the agreement between theory and experiment is fairly good for ionization and kinetic temperatures, but poor for the excitation temperature. The H_β line tends to vanish more rapidly than theoretically predicted. (auth)

5950

ION-ELECTRON RELAXATION OF PLASMAS IN A STRONG MAGNETIC FIELD. [PART] I. Taro Kihara (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1751-4(1959) Dec. (In English)

The relaxation rate between ion and electron temperatures of dilute fully ionized gases in a magnetic field is discussed. Expressions for calculating the rate of relaxation in intermediate and strong magnetic fields and the case of no magnetic field are presented. In deriving the expressions, the mean gyration radius was assumed to be much smaller than the Debye length. (C.J.G.)

5951

MEASUREMENT OF PLASMA TEMPERATURE AND ELECTRON DENSITY. Kiyoshi Murakawa and Shizuyo Hashimoto (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1824 (1959) Dec. (In English)

A method of measuring the temperature of a plasma obtained by passing a condensed discharge through a Geisler tube containing neon was previously reported. Corrections are presented for the previous paper on: the electron density, N; the displacement of NeIλ 5852 due to the condensed discharge; half-value width due to broadening effect of ions and electrons; and the plasma temperature. (C.J.G.)

5952

THE VORTEX EQUATIONS OF MAGNETO-HYDRODYNAMICS. H. C. Brinkman (Centraal Laboratorium T.N.O., Delft, Netherlands). Physica 25, 1063-6(1959) Nov. (In English)

The vortex equations of magnetohydrodynamics are derived. Three vorticities, viz. a material, an electrical and a magnetic vorticity are introduced. In their integral form, i.e., as equations for the material and the electrical circulation, the equations are applied to a rotating plasma in a thermonuclear device. (auth)

5953

THE INVERSE SKIN EFFECT. M. G. Haines (Imperial College, London). Proc. Phys. Soc. (London) 74, 576-84 (1959) Nov. 1.

The axial current density in an infinite cylindrical conductor is calculated as a function of radius and time. In the

problem studied the total axial current is specified as a function of time. The case of a rigid conductor is studied first, and the analysis is extended to the case of a radially expanding or contracting cylinder such as occurs in a linear pinched plasma. The radial velocity is assumed proportional to the radius, while the outside radius of the conductor is a general but specified function of time. It is shown that the variation of total current with time can give rise to distributions of current density which bear no resemblance to the normal skin effect. In fact, an inverse skin effect or even reversal of current may occur. This latter effect causes a reversed pinch force and perhaps eventual break-up near the surface of a plasma. Some special total current profiles are used to illustrate these features. (auth)

5954

HEATING PLASMA CONFINED IN A TORUS IN A SLOWLY OSCILLATING MAGNETIC FIELD. H. U. Schmidt (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 14a, 975-89(1959) Nov. (In German)

The heating of a plasma confined in a torus in a slowly oscillating magnetic field is investigated by means of a linearized Boltzmann-equation for the velocity distribution of the plasma-particles. The periodic solution gives the rates of heating by Gyro-Relaxation, production of sound and acceleration of particles. These rates are somewhat different from the rates in an infinite cylinder of plasma. The comparison of the different mechanisms with each other and with the ohmic heating shows Gyro-Relaxation to be an especially suitable mechanism for achieving extreme temperatures. (auth)

5955

SOME PROBLEMS CONCERNING THE DYNAMICS AND HEATING OF A CONDUCTING MEDIUM IN A MAGNETIC FIELD. G. S. Golitsyn (Inst. of Atmospheric Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1062-7(1959) Oct. (In Russian)

The one-dimensional motion of an ideally conducting medium under the action of a magnetic field prescribed at the boundary is analyzed. Confinement of the plasma by a high frequency magnetic field is investigated. Some aspects of the problem of heating a plasma by magnetoacoustic waves are discussed. (auth)

5956

A SIMPLE METHOD FOR CALCULATION OF THE MEAN RADIATION RANGES IN HIGH TEMPERATURE IONIZED GASES. Yu. P. Raĭzer. Zhur. Eksptl'. i Teoret. Fiz. 37, 1079-83(1959) Oct. (In Russian)

The absorption coefficients of light in high temperature multiple ionized gases are considered. A simple approximate method is proposed which permits one to rapidly estimate the order of magnitude of the range of light averaged over its spectrum. The ranges determine the coefficient of radioative thermal conduction and the emissivity of any gas at various temperatures and densites. (auth)

5957

EQUILIBRIUM OF A PLASMA TORUS IN A MAGNETIC FIELD. V. D. Shafranov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1088-95(1959) Oct. (In Russian)

The conditions for equilibrium of a plasma torus with a distributed current in a magnetic field are derived. (auth)

5958

ON CONVECTIVE INSTABILITY OF A PLASMA COLUMN. B. B. Kadomtsev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1096-1101(1959) Oct. (In Russian)

Stability with respect to axially symmetrical perturbations, including perturbations of the entropy wave type, are investigated for a plasma column with a distributed current. (auth)

5959

EFFECTS OF VACUUM FLUCTUATIONS ON POLARIZATION OF ELECTRONS MOVING IN MAGNETIC FIELD. I. M. Ternov and V. S. Tumanov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1137-9(1959) Oct. (In Russian)

A quantum mechanical explanation of the effects of vacuum fluctuations on the polarization of electrons moving in a magnetic field is presented. The Dirac equation with radiative corrections is taken as the starting point. (R.V.J.)

5960

ENERGY LOSSES IN GAS DISCHARGE PLASMA. V. D. Kirillov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1142-4(1959) Oct. (In Russian)

An analysis is made of energy losses in ohmic heated hydrogen plasma. The experiments showed that the losses are incurred with the emission of impurities and not by radiation. (R.V.J.)

5961

MAGNETHYDRODYNAMICS FLOW EXPERIMENTS OF A STEADY STATE NATURE. Vernon H. Blackman (MHD Research, Inc., Newport Beach, Calif.). New York, American Rocket Society, 1959. 15p.

A description is given of a plasma flow facility which utilizes an arc chamber with argon as the working gas. The gas passes through a mixing chamber then enters a Laval nozzle from which it exits at low pressure supersonic flow into a water-cooled vycor tube which serves as the test section. The gas flow is then cooled by a heat exchanger and exhausted by a vacuum pump. Expressions are given for determining the flow velocity, flow conductivity, and the value of the magnetic Reynolds number. A method for measuring the conductivity of the flow by the skin depth of the electromagnetic radiation is presented. The results of experiments to affect the flow with a "magnetic nozzle" and application of a magnetic field transverse to the flow are presented. Electron temperatures as high as 14,000°K were determined at the exit nozzle. (C.J.G.)

5962

PLASMA PHYSICS AND THERMONUCLEAR RESEARCH. VOLUME 1. PROGRESS IN NUCLEAR ENERGY. SERIES XI. C. Longmire, James L. Tuck, and W. B. Thompson, eds. New York, Pergamon Press, 1959. 628p. $15.00.

The edited proceedings of the Geneva Conference pertaining to plasma physics and thermonuclear research are presented. Sections are included on general progress, particular devices, theoretical work, and miscellaneous devices. (W.D.M.)

Shielding Calculations

5963 Hw-56593

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TRANSVERSE STREAMING TESTS IN THE DR SHIELD TEST WELLS. D. E. Wood and E. G. Peterson. June 30, 1958. 9p. Contract W-31-109-Eng-52. OTS.

Past experiments on neutron attenuation of various materials conducted in the vertical shield test wells on top of the DR reactor has led to the question of streaming out of the well or up the edges of the wells. Horizontal traverses were taken in the DR vertical shield test wells to investi-

gate the problem of neutron streaming. Both fast and thermal neutron traverses were taken to within three inches of the edge of the well. A temperature traverse showed that the concrete in the well was quite warm. (W.D.M.)

5964 ORNL-2528
Oak Ridge National Lab., Tenn.
RADIATION TRANSMISSION THROUGH BORAL AND SIMILAR HETEROGENEOUS MATERIALS CONSISTING OF RANDOMLY DISTRIBUTED ABSORBING CHUNKS. W. R. Burrus. Jan. 18, 1960. 30p. Contract W-7405-eng-26. OTS.

Shields that consist of randomly distributed absorbing chunks in a relatively transparent matrix must contain a greater mass of absorber than homogeneous shields which provide the same attenuation. This is the result of radiation "channeling" between the absorbing chunks. Channeling is particularly important for heterogeneous materials when the mean free path for absorption is comparable to the chunk size. A newly developed method for calculating the transmission of radiation through such heterogeneous shields is described. The numerical results of a calculation of the transmission of thermal neutrons by boral (a B_4C-Al mixture) are given, including the effects of energy and angular distributions on the predicted attenuation. The calculated results are in reasonable agreement with available experimental results. (auth)

5965
NEW SHIELDING MATERIALS FOR HIGH-TEMPERATURE APPLICATION. H. E. Hungerford, R. F. Mantey, and L. P. Van Maele (Atomic Power Development Associates, Inc., Detroit). Nuclear Sci. and Eng. 6, 396-408(1959) Nov.

Investigation and development of several new materials for high-temperature shields have yielded three reasonably cheap materials which are structurally stable and able to withstand high temperatures and high radiation fields. Calculations indicate good neutron attenuation properties. These materials have undergone extensive development and testing for both physical and radiation effect data. They are (1) serpentine rock, (2) calcium borate, and (3) borated diatomaceous earth. Serpentine rock ($3\,MgO \cdot SiO_2 \cdot 2H_2O$), as asbestos mineral, retains its water of hydration to temperatures as high as 950°F. It can be used either dry-packed, or as the aggregate in concrete, with densities attainable of about 130 lb/cu ft. Structurally, the aggregate is not quite as good as concrete. Calcium borate is the commercial name applied to a number of borated calcium minerals pressed into an asbestos matrix to give a boron content of about 12 wt.%, with a density of over 70 lb/cu ft. Although the composite is brittle, it can be fabricated into shapes rather easily. Tests indicate it will withstand temperatures up to 1800°F with less than 3% shrinkage, and can be exposed to a neutron irradiation of 2.4×10^{20} nvt without damage. Diatomaceous earth, a porous commercial refractory material, was successfully borated to the extent of about 2 wt.% boron. It can be used as an aggregate in portland or lumnite concrete to give good strength properties and densities of 78 to 82 lb/cu ft. (auth)

Theoretical Physics

5966 AFOSR-TN-59-1071
California Univ., Berkeley.
SPECTRA REPRESENTATIONS IN PERTURBATION THEORY. III. THE SCATTERING AMPLITUDE WITH TWO COMPLEX INVARIANTS. Jan Tarski. [1959]. 46p. Contract AF49(638)-327.

The partial Feynman amplitude corresponding to a particular fourth order diagram is examined as a function of energy and momentum transfer with both of these variables complex. The region of regularity of this function is found, and the types of singularities at the remaining points are determined. An approach which requires only elementary calculations is developed. The condition for the validity of Mandelstam's representation in the fourth order is obtained. Spectral representations for exchange scattering processes at fixed momentum transfer are discussed as another application of the principal results. (auth)

5967 NP-8163
Westinghouse Electric Corp. Research Labs., Pittsburgh.
THEORY OF SECONDARY ELECTRON EMISSION UNDER ELECTRON BOMBARDMENT. Scientific Paper 6-94410-2-P9. E. J. Sternglass. July 23, 1957. 57p.

On the basis of a detailed investigation of the primary electron interaction process with the atoms of a solid, a theory is formulated that predicts closely the absolute magnitude and form of the observed yield curves for all pure metallic and semi-conducting elements on which data are available in the literature. The scattering of the primary electrons rather than their total range measured along their tracks is shown to determine the depth at which the secondaries are formed. The interaction with the bound electrons is found to dominate over the collisions with the conduction electrons, leading to a dependence of the yield on atomic rather than collective properties of the material. The yield is found to be a function only of the atomic radius, the number of outer shell electrons, and the mean binding energies of these electrons but not of the conductivity, lattice-spacing, or work-function of the solid. The mean depth of secondary formation is shown to increase approximately as the one-half power of the primary energy, and the observed values of the yield are found to be consistent with a mean free path for secondary electrons of the order of a few lattice spacings, in contrast to the much longer mean free paths of conduction electrons. The role of the work-function in the escape of the secondaries is discussed in detail. It is concluded that the surface transmission coefficient is only determined by the magnitude of the dipole moment of the surface atoms and not the total work-function. (auth)

5968 CEA-tr-X-157
THEORIE DES PERTURBATIONS. (Perturbation Theory). José A. Garcia Fite. Translated into French from Energia nuclear (Madrid) 2, No. 7, 68-79(1958). 31p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2573.

5969
EQUATIONS FOR THE GREEN FUNCTIONS IN QUANTUM ELECTRODYNAMICS. Jan Fischer (Joint Inst. for Nuclear Research, Dubna, USSR). Czechoslov. J. Phys. 8, 379-89 (1958) (In English)

Using the Freese-Matthews-Salam equations for chronological products of field operators, equations are written for Green functions of many electrons and photons. It is shown that in order to find any single Green function an infinite recursive system of these equations has to be solved. After adding terms containing the external electric current and external electromagnetic potential to the Lagrangian, this system is reduced to one equation containing functional derivatives of higher orders. It is shown that all relations and equations become much simpler when the definition of the Green function is appropriately changed. (auth)

5970
ON THE FIELD-MATTER INTERACTION IN CLASSICAL ELECTRODYNAMICS. [PART] I. I. Prigogine and Boris Leaf (Université Libre, Brussells). Physica 25, 1067-79 (1959) Nov. (In English)

The problem of the interaction between a classical charged particle and its own electromagnetic field is treated by a method previously used to study different problems in statistical mechanics. It involves a perturbation method based on the Liouville equation which yields the distribution function for a system in phase space. The interest in this method comes from the fact that with the Liouville equation one can uniquely represent the behavior of the field system and matter to partial derivatives using one linear equation. It is shown that at the e^2 order the only modification introduced by the field in the absence of exterior forces is a renormalization of the mass. This method is almost like the ordinary quantum mechanics of fields. It is more adaptable to complex systems than the classical method, however. A study was also made of the movement of a charged particle in a black body at a finite temperature. In this case the mass of the particle depends on the temperature, thus making possible in principle a distinction between the electromagnetic mass and the original non-electromagnetic mass. Moreover, the formalism obtained for the movement of a particle is derived only in the case of a hamiltonian. Thus, a delta distribution function (the classical pure case) is transformed to a packet which enlarges with time. The significance of these results is discussed. (T.R.H.)

5971
PERTURBATION THEORETICAL CALCULATION OF SELF-ENERGY AND MASS OF POLARONS. G. Höhler and A. Müllensiefen (Universitat, Munich). Z. Physik 157, 159-65(1959) Oct. (In German)

The perturbation theoretical results for the self-energy and the mass of the polaron are given in 4-th order. Even for a coupling strength usually assumed in NaCl ($g^2 = 6$) the deviations from the values found in Feynman's variational approach are negligible. A remark concerning the approximation character of Feynman's method is made from the comparison of the expressions for the self-energy. (auth)

5972
POLARIZATION AND TIME REVERSAL INVARIANCE IN STRONG INTERACTIONS. Peter Stichel (Physikalische Staatsinstitut, Hamburg). Z. Physik 157, No. 1, 89-97 (1959). (In German)

The Satchler-theorem about a relation between the spin tensor moments produced in a two particle reaction, and the angular distribution induced by these moments in the time inverse reaction is generalized in a relativistic covariant manner. (auth)

5973
THE INITIAL-VALUE PROBLEM OF DECAYING STATES Joachim Petzold (Universität, Heidelberg, Ger.). Z. Physik 157, No. 1, 122-9(1959). In German)

The probability of decay of a quantum mechanical system is completely determined by the energy spectrum of the initial state. An exponential law of decay is obtained only if the spectrum has a long tail. Since the initial state is spatially localized, the decay energy and decay constant are fixed by the poles of the S-function. (auth)

5974
INCOMPATIBILITY OF THE ANALYTICITY AND UNITARITY CONDITIONS IN LEE'S MODEL K. A. Ter-Martirosyan. Zhur. Eksptl'. i Teoret. Fiz. 37, 1005-9 (1959) Oct. (In Russian)

It is shown that outside the framework of the Hamiltonian formalism when only selection rules characteristic of Lee's model are taken into account, the analyticity condition leads to a contradiction (even in the simplest N + θ sector) with the unitarity condition. Due to the presence of cross symmetry, this contradiction does not arise in the usual meson theories (at least for a static nucleon in the one meson approximation which in the Lee model is analogous to the case of a N + θ sector). (auth)

5975
ON THE NUCLEON-CORE MODEL WITH A VIBRATIONAL EXCITATION SPECTRUM OF THE CORE. D. P. Grechukhin (Moscow State Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1026-33(1959) Oct. (In Russian)

The nucleon + core model with intermediate coupling between the nucleon and phonon excitations of the core has been considered in a number of works as a possible way of describing the spectra on odd nuclei in the atomic weight region in which even-even nuclei possess level spacings similar to the vibrational quadrupole excitations of the nuclear surface (phonons). The state of the nucleon + core system is a superposition of nucleon states and core states with various numbers of phonons. The energy levels and wave functions of the system have been approximately determined by diagonalizing the energy matrix which is cut off at a certain number of phonons N. Convergence of the approximation when the cut-off is carried out at various values of N is investigated in the present work for the simple model of spinless phonons whose energy matrix retains the main features of the matrix for phonons with spin. (auth)

5976
ON NONCONSERVATION OF PARITY IN STRONG INTERACTIONS BETWEEN STRANGE PARTICLES. S. G. Matinyan (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1034-40(1959) Oct. (In Russian)

A modification of Lee and Yang's theory of strange particle parity doublets is considered in which parity conjugation invariance is extended to weak interactions. As a result, nonconservation of parity in weak interactions is found to be closely related to a change in strangeness. Results of the analysis pertaining to the "forward-backward" asymmetry of the hyperon decay products are compared with the corresponding consequences due to nonconservation of parity in strange particle creation and interaction processes. Both interpretations are found to yield the same results so long as particles with odd strangeness are concerned. The two approaches can be distinguished by studying processes involving Ξ hyperons. (auth)

5977
CLASSIFICATION OF MOLECULAR TERMS WITH RESPECT TO THE TOTAL NUCLEAR SPIN. E. G. Kaplan (Inst. of Chemical Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1050-3(1959) Oct. (In Russian)

A method is suggested for determination of the nuclear multiplicities of molecular terms for nuclei of arbitrary spin. The relation between the Young schemes and a total spin, on the one hand, and the permutation group of the molecule, on the other, is used. (auth)

5978
ON THE INERTIA NUCLEAR MOMENT THEORY. Yu. K. Khokhlov (Lebedev Inst. of Physics, Academy of Sciences,

USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1136-7(1959) Oct. (In Russian)

An attempt is made to find a connection between two different determinations of the nuclear inertia moment offered by D. R. Inglis (Phys. Rev. 96, 1059(1954)) and A. Bohr et al. (Preprint, 1958) on one side and F. Villars (Ann. of Phys. 5, 224(1958)) and S. Hayakawa et al. (Prog. Theor. Phys. 18, 396(1957)) on the other side. (R.V.J.)

5979

TRANSITION PROBABILITIES BETWEEN ROTATIONAL STATES OF NON-AXIAL ODD NUCLEI. Van Lin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1153-5(1959 Oct. (In Russian)

Rotational nuclear states, consisting of one outer nucleon of $j = 1/2$ state and non-spinning shell of triaxial ellipsoid shape, were studied previously by A. C. Davydov (Zhur. Eksptl'. i Teoret. Fiz. 36, 1555(1959)). Calculations are made of the magnitude of coefficients $A^{r}_{K\Omega}$ for the states $I = 3/2$ and $5/2$. (R.V.J.)

5980

ON THE INFLUENCE OF PAULI'S PRINCIPLE AND SHORT-ACTING NUCLEAR FORCES ON THE MECHANISM OF PHOTON ABSORPTION BY NUCLEI IN OSCILLATOR MODEL. V. A. El'tekov (Moscow State Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1166-8(1959) Oct. (In Russian)

Published data postulate that in the oscillation law of nuclear interactions the collective and single-body mechanisms of the giant resonance are equivalent. In transitions to the real nucleus the short-acting nuclear forces and Pauli's principle tend to disturb the established equivalence. Calculations were made of $N_{\sigma_4\tau_4}$ for the ground state He^4 nucleus with pair potential oscillating at short distances between nucleons and converting into zero at distances above 1.7×10^{-12} cm. A more pronounced depression is anticipated in transitions to heavier nuclei. It is obvious that Pauli's principle tends to depress collective degrees of freedom, hence the collective model of the electric dipole excitation mechanism can be applied only to the lightest nuclei while the single-nucleon and dinucleon mechanisms are of primary importance in heavier nuclei. (R.V.J.)

5981

EXCHANGE FACTOR IN THEORY OF COLLISIONS. R. K. Peterkop (Latvia State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1172-3(1959) Oct. (In Russian)

A mathematical variation is suggested for the theory of collisions in which the difference in the effective cross sections is due to the exchange term produced by the continuous spectrum functions ϕ_α and not by the disparity of a^{+}_{α} and a^{-}_{α}. (R.V.J.)

5982

INTRODUCTION TO THE THEORY OF QUANTIZED FIELDS. N. N. Bogolyubov (Bogoliubov) and D. V. Shirkov. Translated from the Russian by G. M. Volkoff. Interscience Monographs in Physics and Astronomy. Volume III. New York, Interscience Publishers, Inc., 1959. 734p.

This book was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15588.

REACTOR TECHNOLOGY

General and Miscellaneous

5983 AECU-4536

General Atomic Div., General Dynamics Corp., San Diego, Calif.

FATE OF FISSION PRODUCT GASES IN THE COOLANT STREAM. Leo Brewer. Aug. 4, 1959. 3p. Project No. 32. Contract AT(04-3)-314. (GAMD-903). OTS.

The quantity and characteristics of fission products in coolant gases due to leaking fuel elements are discussed. It is concluded that the rare gases, the alkali metals, the halides, and Sb may act as permanent gases to a considerable extent. The other fission products are expected to condense out completely on walls or as dust consisting of metals, carbides, and oxides. (J.R.D.)

5984 AECU-4539

General Atomic Div., General Dynamics Corp., San Diego, Calif.

VAPORIZATION PROCESSES IN A RUNAWAY REACTOR. Leo Brewer. Aug. 4, 1959. 6p. Project No. 32. Contract AT(04-3)-314. (GAMD-919). OTS.

From the point of view of constituents of a fuel element at temperatures between 2500 and 4500°K, the fuel elements can be considered to consist of six types of material: carbon, elements less volatile than carbon, 26 moles of rare gases, 21 moles of alkali metals, 17 moles of alkaline earth metals, and 4 moles of miscellaneous volatile elements. Various processes involving the constituents from 2000 to 4500°K are considered. Reactivity gain due to can rupture is discussed. (W.D.M.)

5985 AECU-4599

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDIES OF REACTOR CONTAINMENT. Monthly Technical Progress Report No. 29 for September 1, 1959 through September 30, 1959. T. A. Zaker. Oct. 23, 1959. 4p. ARF Project No. 4132. Contract AT(11-1)-528. OTS.

The general objectives of the program are to accomplish theoretical and experimental investigations of the loads to which external containment structures for reactors are subjected in the event of a violent incident at the reactor core, the evaluation of methods of reducing that loading, and the study of the response of design criteria for external containment structures as a result of such loading. Progress of technical effort during the report period is briefly summarized for each of the eight tasks of the program. (See also ARF-4132-11.) (W.D.M.)

5986 ATL-A-103

Advanced Technology Labs., Div. of American-Standard, Mountain View, Calif.

VARIABLE MODERATOR REACTOR DEVELOPMENT PROGRAM. Quarterly Progress Report No. 2. Nov. 30, 1959. 26p. Contract AT(04-3)-250, Project Agreement No. 3. OTS.

The hydrodynamics code BOCH was used to obtain the relationship between a large number of variables such as voids, flux, pin spacing, power density, and pressure for VMR lattices. Based upon these relationships, a reference core design was selected for examination, using the integrated physics and hydrodynamics analytical models. The analog representations of the VMR core kinetics describing the individual blocks of a model block diagram were completed. A simplified core physics analysis was completed, and design parameters were established. An analysis of these parameters using PUREE' was initiated. The first three energy groups and the thermal group were compared with experimental lattices. Portions of the developed code are being used to analyze the critical experiment design and to investigate the reference core design. The critical experiment facility design is about 60% complete. The preliminary program which has been planned includes consideration of the number, kinds, and schedule of experiments to be performed. Portions of the PUREE' physics analysis

are being used to generate information for the hazards report on the critical experiment. (For preceding period see ATL-A-100.) (J.R.D.)

5987 CEA-952

France. Commissariat à l'Énergie Atomique, Paris.
DESCRIPTION DES RÉACTEURS G2–G3. (G 2 and G 3 Reactor Design). Herreng, [André] Ertaud, and Pasquet. 1958. 52p.

The "France Atome" Manufacturers Party has been entrusted with the G 2 and G 3 reactor engineering by the French A.E.C., for the first-five-year French project. Although these reactors are essentially plutonium generators, each has been linked with a power station which is supposed to supply 40 Mw for which "l'Electricité de France" has taken the liability upon itself. The reactor core includes (central gap excluded): horizontal channels, graphite parallelepipedic bricks, and steel thermal shield. The cooling is provided by CO_2 at 15 atmospheres pressure. This pressure is kept steady in a press-stressed concrete packing-case which is a horizontal cylinder. Steel strips encircle the concrete cylinder; itself protected by sole-plates. The cylinder bottom has brought about unusual problems which have been solved by the choice of an hemispheric shape. Packing-case tightness is provided by a 30 mm iron-plate connected with the inner wall of concrete. One of the reactor's special characteristics is the possibility of loading and unloading while operating. On loading side, barrel locks, each weighing 50 tons, allow new cans, at a pressure of 15 atmospheres, to pass. The cans process almost continuously through the channel, and finally drop down through bent spouts, then through spiral chutes into a new lock. The cooling CO_2 flow is provided with 3 turbo-bellows actuated by average pressure steam obtained from exchangers. Every reactor supplies 4 exchangers which have been very difficult to build and to set up. The secondary cycle is standard and contains 3 stages (pressure 10.3–0.5 kg/cm^2). Steam can be condensed in the event of a group turbo-generator stopping, with no modification for the normal operating conditions of the reactor. Auxiliary circuits have to assure the continuous purifying of cooling CO_2, its storage and drain. 49 boron carbide rods are used to control operating power levels. (auth)

5988 CEA-1054

France. Commissariat à l'Énergie Atomique, Paris.
MESURE ET REGULATION DU NIVEAU D'UN REACTEUR HOMOGENE AU PLUTONIUM. (Measurement and Regulation of the Level of a Homogeneous Plutonium Reactor). F. Berger and J. Bertrand. Dec. 1958. 82p.

Reactivity depends strongly on disturbances of the level of the plutonium solution in the homogeneous reactor. Proserpine has a small cylindrical core, 250 mm diameter, and 10 liters volume. With a view to reducing the dangers due to corrosion and contamination, the solution level in the core is raised by pneumatic pressure. The level is stabilized by means of a regulating system. During critical experiments the variations of the level are less than one hundreth part of a millimeter. (auth)

5989 CF-58-12-154

Oak Ridge National Lab., Tenn.
INSPECTION AND MAINTENANCE EXPERIENCE WITH HRE-2. J. S. Culver, D. M. Shepherd, and C. W. Collins. Dec. 26, 1958. 23p. OTS.

Presented at the Nuclear Engineering and Science Conference in Cleveland, Ohio, in April 1959.

Experience in replacement of highly radioactive components of Homogeneous Reactor Experiment No. 2 is discussed, with particular emphasis on containment of air-borne contamination and control of personnel exposure. The design and operation of tools and viewing devices developed to observe the hole in the HRE-2 core tank are described. (auth)

5990 CF-59-12-16

Oak Ridge National Lab., Tenn.
EFFECT OF NON-THERMAL CAPTURE ON CALIFORNIUM PRODUCTION IN THE HFIR. H. C. Claiborne. Dec. 3, 1959. 12p. OTS.

Non-thermal neutron capture was estimated to enhance the production rate of Cf^{252} in the HFIR by 50 to 100% depending on the Cm^{248} cross section. The optimum ratio of non-thermal to thermal neutron flux was very dependent on the Cm^{248} thermal cross section. It was concluded that the present nuclear design is close to the practical optimum with respect to the ratio of thermal to non-thermal neutron flux. (auth)

5991 GEAP-3129

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
AUTOMATIC CONTROL OF BOILING WATER REACTORS. M. A. Head. Mar. 12, 1959. 25p. (R-59-APE-11).

Normal boiling water reactor (BWR) operation, the experimental BWR observations, and various methods of BWR control are discussed. The operation of BWR's is described in order to grasp the problem of BWR control. This description includes the operation of the experimental reactors, BORAX, SPERT, EBWR, and VBWR. In this way a physical picture is provided of operational details, such as the effects (on power) of pressure, subcooling, and coolant flow. With this picture in mind, the various methods of control are explained, and the performance that can be obtained from these control methods is estimated. To evaluate these control methods the reactor plant must be analyzed. The method of analysis is outlined, and results or conclusions from this method are presented. (auth)

5992 HW-59638

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRTR GAS-COOLED LOOP, HAZARDS SURVEY OF PRELIMINARY SCOPE DESIGN. N. G. Wittenbrock. Apr. 20, 1959. 24p. Contract W-31-109-Eng-52. OTS.

A gas-cooled loop is being designed for installation in the Plutonium Recycle Test Reactor. This loop will be used for studies of the effect of gas-cooled reactor coolants on graphite. In addition to graphite studies, fuel elements operating at powers up to 500 kw will be tested in the loop. The carbon dioxide coolant will be pressurized to 500 psig and the maximum test section outlet temperature will be 1500°F. Analysis of the preliminary scope design for the gas loop revealed no adverse effect on the nuclear safety of the PRTR. Insertion of the gas loop test section in the PRTR core will have a slight effect on the reactivity of the Core (5 milli-k). This negative reactivity will be compensated by charging one additional spike enrichment fuel element. Safety features incorporated in the design include: a calandria shroud tube cooling loop, an electric power backup, an emergency light water coolant injection, and reactor safety circuit trips. In the event of an accident in the gas loop any fission products released to the environs should result in no injury or crop damage. (auth)

5993 HW-61761

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NEW PRODUCTION REACTOR THERMAL SHIELDING

STUDIES. S. J. Friesenhahn. Aug. 31, 1959. 9p. Contract [AT(45-1)-1350]. OTS.

The relative neutron capture gamma production in several prospective iron thermal shielding materials for the New Production Reactor was measured to determine the merit of adding boron to the metal. It was found that for the beam geometry the used addition of 1½% boron to the iron before casting reduced the soft gamma production by a factor of 6.5 and the hard gamma production by a factor of 10. No attempt was made to measure gamma or neutron transmissions. (auth)

5994 KAPL-M-ELW-10

Knolls Atomic Power Lab., Schenectady, N. Y.

ISOTOPIC SHIELDED POISON BURNOUT. E. L. Wachspress. Nov. 1, 1959. 7p. Contract W-31-109-Eng-52. OTS.

Equations are derived for the burnout of a shielded burnable poison consisting of a homogeneous isotopic mixture. Calculations are given for europium. (W.D.M.)

5995 NYO-2674

TRG, Inc., Syosset, N. Y.

HETEROGENEOUS REACTOR CALCULATION METHODS. Quarterly Progress Report No. 2 [for] July 1–September 30, 1959. Carl N. Klahr and Lawrence B. Mendelsohn. 54p. Contract AT(30-1)-2375. (TRG-129-QTR-2). OTS.

Work directed toward practical use of heterogeneous reactor physics calculations is reported. Thermal utilization and resonance escape probability are calculated for infinite multi-component complex lattices. These calculations permit straightforward and simple analysis of certain reactor cores with multi-component lattices. A description of an IBM-704 code, which will do realistic heterogeneous calculations, and several methods for calculating the fuel element thermal absorption parameters are given. The calculation of more precise rod-to-rod kernels using transport theory is developed. (For preceding period see NYO-2673.) (W.D.M.)

5996 RISÖ-11

Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø.

ON CADMIUM RATIO MEASUREMENTS AND THEIR INTERPRETATION IN RELATION TO REACTOR SPECTRA. Bent Fastrup. Oct. 1959. 24p.

A method is described for calculating the neutron flux spectra–based on Westcott convention–for a reactor from the measurement of the cadmium ratio for foils of finite thickness. Some relations concerning the parameters in the Westcott spectra are evaluated and special studies were carried out on the problem of correlating the cadmium ratio measurements to the shape of the neutron spectra. An exposition is given for measurements carried out at DR-1 with gold foils ranging in thickness from 20 $\mu g/cm^2$ to 100 mg/cm^2. (auth)

5997 RPI-43

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

RESULTS OBTAINED IN THE BLANKET EXPERIMENT UP TO JULY 1958. R. H. Chow, R. G. Jarvis, L. Pease, and G. J. Phillips. Nov. 1958. 7p.

Use of an exponential assembly to measure properties of close-packed lattices such as might be used to blanket a power-reactor is discussed. The total and epi-thermal fluxes were analyzed from a least-squares fitting program, using these data the material bucklings of the lattices were determined. Data are tabulated. (J.R.D.)

5998 WCAP-6041

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. ASSAY CAPABILITIES OF A REACTOR FUELS MEASURING FACILITY. J. A. Vreeland. Dec. 31, 1959. 49p. Contract AT(30-1)-2176, Task I. OTS.

A test reactor was studied which is capable of assaying the content of fissionable material in a reactor fuel assembly. This assay is accomplished by means of two reactivity measurements with different loadings of fuel and moderator which make possible the separation of the effects of neutron absorption in fuel and in poison at the same neutron energies. Thus, it is possible to specify the source of any irregularity in the reactivity and to circumvent even deliberate attempts to divert fuel. Such a reactor would also be of value in studying reactor parameters in lieu of a critical experiment, and also in evaluating spent fuel for refueling or fuel cycling operations. (auth)

5999

COOLANT INSTRUMENTATION FOR PRESSURIZED WATER REACTOR POWER PLANTS. J. J. Lihota and C. B. Hoppa (Westinghouse Electric Corp., East Pittsburgh, Penna.). Commun. and Electronics No. 42, 131-6 (1959) May.

The advantages and problems encountered in the use of magneto-amplifier instruments in coolant control are described. Circuit diagrams are given, and the use of basic modules such as the bridge, demodulator, self-balancing amplifier, bistable controller, and summing modules are explained. Circuit diagrams are given for typical differential transformer instruments and master shutdown controller channels. The positioning of detectors for effective coolant system instrumentation is discussed. (C.J.G.)

6000

COMPUTATIONAL AND EXPERIMENTAL TECHNIQUES IN NUCLEAR REACTOR DESIGN. W. F. Witzig, M. R. Stuart, and L. O. Herwig (Westinghouse Electric Corp., Pittsburgh). Commun. and Electronics No. 42, 155-63 (1959) May.

The nuclear design sequence of a reactor, beginning with the reactor objective and continuing through to core construction is discussed. Problems associated with various phases of design are indicated. The application of computational techniques and experimental methods in reactor design is discussed. (C.J.G.)

6001

A ROD-POSITION INDICATION SYSTEM FOR PRESSURIZED REACTORS. R. C. Floyd and J. F. Reuther (Westinghouse Electric Corp., East Pittsburgh, Penna.) Commun. and Electronics No. 45, 614-18(1959) Nov.

A description is given of a system for determining the absolute position of reactor control rods by detecting the position of magnetic material in the rod extension. The detector is a long slender coil (one leg of an Owen bridge), the inductance of which is varied as the hollow magnetic rod extension passes over it. The change of inductance is a measure of rod position and is used to turn on a limit light which indicates to the operator that the rod is close to bottom position. (C.J.G.)

6002

ANALOG COMPUTERS AND NUCLEAR PLANTS. V. Svelto (Centro Informazioni Studi Esperienze, Milan). Energia nucleare (Milan) 6, 763-7(1959) Dec. (In Italian)

The basic components of an analog computer are reviewed, with particular care being given to the required

precision. Then the principal problems that are dealt with in the nuclear field and the range of the minimum number of fundamental components sufficient for the solving of typical problems which are encountered in the study of power reactor regulation are shown. (auth)

6003

FUEL ELEMENTS, FUEL ELEMENT CLADDING AND REACTOR CONSTRUCTION MATERIALS. II. REACTOR CONSTRUCTION MATERIALS. Jaroslav Pluhař and Jaroslav Vrtěl (Státní výzkumný ústav materiálu a technologie, Prague). Jaderná energie 5, 331-5(1959). (In Czech.)

Materials used for control systems are evaluated and main problems connected with the choice of reactor pressure vessel materials are indicated. Measures required for satisfying the material demands in our metallurgy are reported, and the main problems which are to be solved in Czechoslovakia, are indicated. (auth)

6004

REACTIVITY ASSOCIATED WITH THE DECAY OF Np^{239} IN IRRADIATED NATURAL URANIUM DIOXIDE. S. B. Gunst (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 6, 376-8(1959) Nov.

In the calculation of irradiation-induced changes in reactivity in natural uranium, the direct formation of Pu^{239} upon neutron capture in U^{238} is frequently assumed. The attendant error in reactivity during irradiation is shown to be significant for an illustrative case even after high exposure. This suggests that the consequences should be examined when the direct formation of Pu^{239} is assumed. (auth)

6005

ANALYTIC SOLUTIONS FOR TRANSIENT TEMPERATURE DISTRIBUTIONS IN TWO-REGION NUCLEAR REACTOR FUEL ELEMENTS. Francis Narin and David Langford (Armour Research Foundation, Chicago). Nuclear Sci. and Eng. 6, 386-90(1959) Nov.

Analytic solutions are developed for the transient temperature distributions in two-region nuclear reactor fuel elements. One region contains a space-independent heat source having an arbitrary time dependence; the other region is source-free. Infinite cylinder and infinite slab geometries are considered, and simplifying assumptions are discussed which reduce the general solutions to simple forms of special interest in reactor safety studies. (auth)

6006

SIMPLIFIED SIMULATION OF A BOILING WATER REACTOR POWER PLANT. Robley E. George and Alexander Sesonske (Purdue Univ., Lafayette, Ind.). Nuclear Sci. and Eng. 6, 409-13(1959) Nov.

Using analog computer facilities available at most universities, a boiling water reactor power plant was simulated in order to study for instructional purposes the system response to various deviations from normal operation conditions. The rather idealized model, which was similar to EBWR, was found to be quite stable and to behave qualitatively in a manner expected from boiling reactor experience. (auth)

6007

AUTOCORRELATION FUNCTIONS OF COUNTING RATE IN NUCLEAR REACTORS. Carlos Vélez (Instituto Nacional de la Investigación Cientifica, Mexico City). Nuclear Sci. and Eng. 6, 414-19(1959) Nov.

The general form of the autocorrelation function of the counting rate in a nuclear reactor is established. The autocorrelation function is computed in two examples and the expressions thus obtained are compared with the results of experiments. (auth)

6008

NEW IDEAS FOR NUCLEAR REACTORS. Eugene P. Wigner (Princeton Univ., N. J.). Nuclear Sci. and Eng. 6, 420-32(1959) Nov.

Early nuclear power reactor concepts were generated mainly by a few theoretical physicists during the relatively few quiet hours available in 1942 to 1945. Reactors were thought of in terms of structures "that a plumber could put together." A typical illustration of early thinking is presented. In spite of these primitive beginnings, the basic technical pattern of power reactor development was understood at an early date. Estimates of world energy resources are summarized. It is pointed out that the great effort to exploit nuclear energy can be justified only if it is directed toward a full utilization of uranium and thorium. Without breeding, nuclear fuels will only supply energy for a few decades in the future energy-hungry world. Recent findings on nuclear reactor stability are discussed and the value of computing machines in theoretical studies is noted. A commentary on current concepts in reactors is presented; the flux trap reactor, boiling reactors, gas-cooling, and breeders using beryllium or U^{238} for possible improvement of neutron economy. Direct conversion of nuclear heat into electricity is briefly reviewed. Thermocouple batteries and thermionic converters are described and some remarks are made concerning their future development. (auth)

6009

VALIDITY OF THE B_1 METHOD FOR FUEL CYCLE ANALYSIS. S. A. Hasnain and Raymond L. Murray (North Carolina State Coll., Raleigh). Nuclear Sci. and Eng. 6, 455-6(1959) Nov.

The method for burnup analysis for fixed fuel thermal reactors makes use of two simplifications, (a) separability of flux in space and time and (b) representation of flux by the bare-equivalent flux shape. It was proposed to establish the conditions for validity of these approximations and to extend the analysis by the use of additive corrections to the burnup functions. For large reactors the correction is shown to be unimportant. (B.O.G.)

6010

THE SLOWING-DOWN SPECTRUM IN A HETEROGENEOUS REACTOR. C. B. Bigham and R. M. Pearce (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nuclear Sci. and Eng. 6, 457-8(1959) Nov.

Deviations from the 1/E-form that occur in rod-type reactors as a result of the heterogeneous nature of the fission sources were studied. The slowing-down spectrum was measured at four energies by measuring the specific activities induced under 0.076-cm thick cadmium foil. The measurements were performed in the central cell of ZEEP on a horizontal line passing through the neighboring rods. The energy levels used in this experiment were 6.7 ev, 21 ev, and 37 ev in the 1/E spectrum. (B.O.G.)

6011

SEARCH FOR POSITRON EMISSION IN K^{40}. D. R. Tilley and Leon Madansky (Johns Hopkins Univ., Baltimore). Phys. Rev. 116, 413-15(1959) Oct. 15.

A search for positron emission in K^{40} was made with the use of a triple coincidence technique. An upper limit of $(3.6 \pm 1.8) \times 10^{-4}$ positron per second per gram of natural potassium was set. A corresponding upper limit of 0.59 ± 0.28 was computed for the ratio of the squares of the matrix elements, M_+^2/M_-^2, for the K^{40} β^+ and β^- transitions. (auth)

6012
ON THE THEORY OF DIFFUSION COOLING OF NEUTRONS IN A FINITE SOLID MODERATOR ASSEMBLY. K. S. Singwi (Argonne National Lab., Lemont, Ill.). Reactor Sci. 11, 19-20(1959) Nov.

An expression was obtained for the diffusion cooling constant of neutrons in a finite solid moderator. The expression utilizes the transport equation in the diffusion approximation and the velocity distribution expansion of the neutron flux in terms of generalized Laguerre polynomials of order unity and degree n, each of which is multiplied by a Maxwellian distribution function. The first three terms in the Laguerre expansion are retained. The assumption of neutron temperature in the expression is completely avoided. (C.J.G.)

6013
SOVIET NUCLEAR PROPULSION. R. G. Perel'man. Translated from the Russian. Washington, D. C. Triumph Publishing Co., [1959]. 45p. $2.85.

Developments in nuclear transportation and propulsion in the Soviet Union are reviewed. Extensive developments are forecast for the future. (C.H.)

Power Reactors

6014 AECU-4574
Duquesne Light Co., Shippingport, Penna.
CONDENSATE SYSTEM. SECTION II. CORE I, SEED I. Test Results DL-S-105. First issue, Dec. 8, 1959. 11p. OTS.

Tests were conducted to obtain satisfactory preliminary condensate system operation and to fill the system and condensate storage tank. The components of the condensate system performed satisfactorily with the exception of fill control valve; however, this valve is not used in the current operating procedure. (J.R.D.)

6015 AECU-4575
Duquesne Light Co., Shippingport, Penna.
TURBINE START-UP. SECTION I. SECOND PERFORMANCE. CORE I, SEED I. Test Results DL-S-175. First issue, Dec. 14, 1959. 12p. OTS.

Tests were conducted to ensure satisfactory operation of the recently overhauled turbine. Test equipment and procedures are described and results are tabulated. The turbine operation was satisfactory. (J.R.D.)

6016 AECU-4576
Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY. SECTION I. EFPH–5465.2. SECOND PERFORMANCE. CORE I, SEED I. Test Results DL-S-231 (T-612394). First issue, Dec. 16, 1959. 11p. OTS.

Tests were conducted to determine the radiation levels in a boiler compartment with the respective loop shutdown and the remainder of the plant operating at power. High radiation was found in the vicinity of the reactor coolant loop pipe, otherwise personnel could continuously occupy the area without exceeding the maximum dose rates. (J.R.D.)

6017 AECU-4577
Duquesne Light Co., Shippingport, Penna.
1A REACTOR INLET HYDRAULIC VALVE POSITION DETECTOR TEMPERATURE. CORE I, SEED I. SECTION I. Test Results DL-S-258-S (RNI-3). First issue, Nov. 20, 1959. 8p. OTS.

Tests were conducted to determine the internal temperature of the valve position detector for the 1A reactor inlet hydraulic valve with the plant at power. The temperature range was found to be 287 to 293.7°F. (J.R.D.)

6018 AECU-4578
Duquesne Light Co., Shippingport, Penna.
LEVELING OF EXTRACTION TOOL CRANE RAILS. SECTION I. SECOND PERFORMANCE. CORE I, SEED I. Test Results DL-S-246 (FY-59-323). First issue, Nov. 30, 1959. 7p. OTS.

Tests were conducted to see that the extraction crane rails in the area of the reactor pit are level and parallel. Data are given on instances in which allowed tolerances were exceeded. (J.R.D.)

6019 AECU-4579
Duquesne Light Co., Shippingport, Penna.
DETERMINATION OF POSSIBLE FAILED BLANKET ELEMENTS USING THE FEDAL SYSTEM. SECTION I. FIRST PERFORMANCE. CORE I, SEED I. Test Results DL-S-281-S (RNI-24). First issue, Nov. 23, 1959. 28p. OTS.

Tests were conducted to determine if failed blanket elements exist in other regions of the core beside F-2. Data from start-up runs at the FEDAL sample port monitors gave no indication of blanket element failure. At each power increase, the radiation increase was normal with no signs of bursts or peaks of radiation which would indicate the failure of a blanket fuel element. (J.R.D.)

6020 AECU-4580
Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY. SECTION III. FIRST PERFORMANCE. CORE I, SEED I. Test Results DL-S-231 (T-612394). First issue, Nov. 30, 1959. 11p. OTS.

Surveys were conducted to determine the radiation levels inside the concrete enclosures but outside of reactor plant containers after shutdown following plant power operation. Results indicate that no significant radiation hazards were present approximately 25 minutes after all rods had been inserted. The radiation levels approximately 4 minutes after shutdown at the survey points in the auxiliary chamber enclosure indicated that several points were above background. (J.R.D.)

6021 AECU-4581
Duquesne Light Co., Shippingport, Penna.
EXAMINATION OF COMPONENTS FOR CRUD AND CORROSION. SECTION I. SECOND PERFORMANCE. CORE I, SEED I. Test Results DL-S-155 (T-612080). First issue, Dec. 7, 1959. 6p. OTS.

Examinations were made to observe the extent and location of corrosion, crud deposits, and defects in components of the primary fluid system and its auxiliaries. The test was limited to the 1D main coolant pump which had failed. Analysis of smear samples from the volute and impeller showed the presence of Co^{58}, Co^{60}, Fe^{59}, Mn^{54}, Hf^{181}, and Zr^{95}. The upper and lower radial pump bearings and journals were severely scored and galled while the thrust bearing and runner appeared to be in good condition. (J.R.D.)

6022 AECU-4582
Duquesne Light Co., Shippingport, Penna.
CHARGING AND DISCHARGING OF DEMINERALIZER RESINS. SECTION IV. FIRST PERFORMANCE. CORE I, SEED I. Test Results DL-S-180 (T-612085). First issue, Dec. 3, 1959. 6p. OTS.

Tests were conducted to determine if the 1A canal water system demineralizers can be satisfactorily charged with resin. Satisfactory charging was noted and the conductivity of the demineralizer effluent was less than 0.1 micromhos. (J.R.D.)

6023 AECU-4583
Duquesne Light Co., Shippingport, Penna.
THE DETERMINATION OF DECONTAMINATION FACTORS FOR RADIOISOTOPES THROUGH LITHIUM HYDROXIDE RESIN. SECTION I. CORE I, SEED I. Test Results DL-S-277-S (RNI-22). First issue, Dec. 3, 1959. 4p. OTS.

Tests were conducted to provide data on the decontamination factors for Cs^{136}, Cs^{137}, Sr^{92}, one hour gross iodine, and I^{131} in LiH resin. The decontamination factors for a particular demineralizer using this resin varied for different radioisotopes. The variation was from 2.3 for Cs^{136} to 77,000 for gross iodine. The decontamination factor for Sr^{92} was not calculated because of the high error introduced by counting methods. (J.R.D.)

6024 AECU-4584
Duquesne Light Co., Shippingport, Penna.
NUCLEAR INSTRUMENTATION OPERATION DURING PLANT OPERATION. SECTION I. FIRST PERFORMANCE. CORE I, SEED I. Test Results DL-S-309 (RNI-41). First issue, Dec. 8, 1959. 4p. OTS.

A test to evaluate the operation of the nuclear instrumentation power range amplifier during start up was conducted. Variations between the compensated ion chamber currents and the test currents were found, and modifications were made to correct for these deficiencies. (J.R.D.)

6025 AECU-4585
Duquesne Light Co., Shippingport, Penna.
MAIN COOLANT PUMP PERFORMANCE TEST. SECTION I. FIRST PERFORMANCE. CORE I, SEED I. Test Results DL-S-290 (T-641326). First issue, Dec. 7, 1959. 39p. OTS.

Tests were conducted to obtain performance data for the main coolant pumps on fast and slow speed at various coolant temperatures. The 1A, 1B, and 1C pumps performed according to the manufacturer's specifications, while the 1D performed below specifications. (J.R.D.)

6026 AECU-4586
Duquesne Light Co., Shippingport, Penna.
CONTROL ROD POSITIONS FOR CRITICALITY. SECTION I. 5032 EFPH. EIGHT PERFORMANCE. CORE I, SEED I. Test Results DL-S-149 (T-550130). First issue, Dec. 9, 1959. 17p. OTS.

A test to determine critical bank heights and bank worths for various rod configurations was conducted. Critical rod bank positions and bank worths for four control rod bank configurations after 5032 EFPH's of operation are presented. (J.R.D.)

6027 AECU-4587
Duquesne Light Co., Shippingport, Penna.
CORE I CONTROL ROD DRIVE MECHANISMS PERIODIC TESTS. SECTION I. NINTH PERFORMANCE. Test Results DL-S-148-I (T-550011). First issue, Nov. 18, 1959. 11p. OTS.

A periodic test to determine the operating condition of the rod drive mechanism was conducted. The operating characteristics of the rod drive mechanisms examined in this test have not changed appreciably from those established in previous tests. (J.R.D.)

6028 BAW-1118
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
NUCLEAR MERCHANT SHIP REACTOR PROJECT QUARTERLY TECHNICAL REPORT FOR APRIL–JUNE 1958. Changed from OFFICIAL USE ONLY May 1959. 168p. Contract AT(30-3)-274. OTS.

A preliminary draft of the erection procedure was prepared from the study of the one-twelfth scale model of the reactor system. The experimental core configuration was changed to the 165 rod/element design. Work was begun on the reference 32 element core, using 0.028 in. fuel cladding and 0.156 in. fuel cans. A study of the release of fission products to the coolant stream showed that the plant could be operated with several defected pins without ill effects from external radiation tolerances. Results of a thermal and hydraulic analysis of a loss of pumping power accident are described. The design performance characteristics of the reference reactor are listed. (For preceding period see BAW-1101.) (W.D.M.)

6029 BAW-1124
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
NUCLEAR MERCHANT SHIP REACTOR PROJECT QUARTERLY TECHNICAL REPORT FOR JULY–SEPTEMBER 1958. Changed from OFFICIAL USE ONLY Aug. 15, 1959. 136p. Contract AT(30-0)-274. OTS.

Studies of the completed one-twelfth scale model of the power plant resulted in some auxiliary system arrangement changes. The large margin of safety inherent in the NMSR design is further emphasized by continued thermal and hydraulic studies. Core nuclear studies resulted in the elimination of burnable poison, since a probable core life of 822 days at 63.5 Mw can be achieved without burnable poison. Experiments by the Critical Experiment Laboratory are described. The fuel enrichment was set at 4.20 wt.% U^{235} for the 16 inner pass fuel elements and 4.60 wt.% U^{235} for the 16 outer pass elements. The change from tube sheet fuel element design to the brazed ferrule design reduced the bundle length from 72 to 69 in. The basic reactor internals designs were established. Modifications were made to the pressurizer, primary coolant pumps, steam generators, primary gate valves, and thermal insulation in the primary system. An 8 in. maximum lead thickness of secondary shield is required to reduce dose rate in passenger spaces to 0.5 rem/year. An 8 in. required minimum polyethylene thickness of secondary shield was calculated to ensure effective removal of the inelastically scattered fast flux. (For preceding period see BAW-1118.) (W.D.M.)

6030 BAW-1125
Babcock and Wilcox Co. Atomic Energy Div., [Lynchburg, Va.].
LIQUID METAL FUEL REACTOR EXPERIMENT QUARTERLY TECHNICAL REPORT [FOR] JULY–SEPTEMBER 1958. Changed from OFFICIAL USE ONLY Sept. 10, 1959. 164p. Contract AT(30-1)-1940. OTS.

Design studies continued on LMFRE-I and the critical experiment. Reactor and systems engineering progress is summarized. Auxiliaries for the Engineering Test Reactor in-pile loop are currently receiving major attention. Design of the Materials Test Reactor in-pile loop is nearly complete and the loop is under fabrication. Additional data have been accumulated on the dynamic loop testing of Croloy 2¼ and Croloy 1¼ in fuel solutions at high velocities. The capsule test apparatus was used to investigate surface finish, effect of time, and other variables. In long-time tests considerable metal transport appeared in the capsules at the higher temperature. The leak test, in which sodium is permitted to contact bismuth in the predetermined leak, has shown no corrosion, erosion, or temperature effects on the Croloy 2¼ material at the leak. Specimens for various mechanical tests are being cut from cemented graphite joints. Information on graphite-to-metal seals and weepage through the graphite cylinders is re-

ported. Data are available on the absorption of bismuth by pieces of graphite in dynamic loop pump sumps. The silicon carbide coatings on graphite have been checked following exposure to bismuth. Additional work on alternate impregnating procedures for graphite has been carried out. Initial valve testing work indicates that some of the units are satisfactory. Bellows testing, now underway, should aid in evaluating application to valves and other components. Induction heating work is now being done on 6-in. rather than 12-in. pipe. Different arrangements of induction coils will reduce the large thermal differences existing under heatup conditions. Additional tests on induction welding have been directed toward thicker wall tubes. Approximate power requirements for the welding cycle have been obtained on a number of tube diameters and wall thickness. The early run on a test loop for slurries has been shut down for examination pending demonstration of a successful slurry in bench scale apparatus. The results of many combinations of thoria and urania with magnesium, zirconium, and other additives, indicate that magnesium will reduce thoria to the metal and that zirconium will reduce uranium oxide to uranium. (auth)

6031 BMI-1396

Battelle Memorial Inst., Columbus, Ohio.

ML-1-1A CORE STUDIES WITH THE GCRE CRITICAL ASSEMBLY. Richard A. Egen, William S. Hogan, David A. Dingee, and Joel W. Chastain. Nov. 27, 1959. 35p. Contract W-7405-eng-92. OTS.

Critical assembly studies were conducted to provide physics and engineering data to aid in developing the Mobile Low-Power Reactor (ML-1). The ML-1-1A core was critical with 59 elements containing 17,906.71 g of U^{235} and had an excess reactivity of 0.381×10^{-2} $\Delta k/k$ at a moderator temperature of 24.91°C. The ratio of maximum element power to core-averaged power was approximately 1.09. The ratio of maximum to core-averaged thermal flux was approximately 1.10. At an 18-deg separation, the shutdown worth of the cadmium-covered control-blade mock-up was 1.14×10^{-2} $\Delta k/k$ for a 69-element core. Radial and upper axial reflector-moderator void coefficients were -0.59 ± 0.07 and $-0.366 \pm 0.015 \times 10^{-2}$ $\Delta k/k$ per in., respectively. Two 1A production fuel elements were evaluated in the critical assembly core. The results predict that the production elements tested contained roughly the same fuel as the critical assembly element and an additional 772 g of stainless steel equivalent on the average. Radial power and neutron flux distributions were measured in a 19-pin 1B fuel element. Fairly uniform distributions were observed. Data to evaluate the thermal utilization of this element were obtained. (auth)

6032 DP-413

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

HEAVY WATER COMPONENTS TEST REACTOR. Papers Presented to The American Nuclear Society on June 17, 1959. L. M. Arnett, comp. Oct. 1959. 35p. Contract AT(07-2)-1. OTS.

A collection of five papers covering some of the preliminary physics studies on the HWCTR is presented. The physical facilities of the reactor are described and some measurements made in a full-scale mockup constructed in the Process Development Pile are discussed. Reactivity transients and coefficients and power, temperature, and pressure transients for a variety of postulated accidents are calculated. Condensations of the papers appeared in Transactions of The American Nuclear Society, Vol. II, No. 1. (W.D.M.)

6033 KAPL-M-NPA-1

Knolls Atomic Power Lab., Schenectady, N. Y.

PERFORMANCE AND EVALUATION OF NATURAL CIRCULATION POWER PLANTS. M. M. Schorr. Dec. 22, 1959. 48p. Contract W-31-109-Eng-52. OTS.

A method of calculating the performance characteristics of a natural circulation nuclear power plant for naval application is developed. The analysis consists of three parts: First, for a given steam generator design the heat transfer characteristics are established using the modified Colburn equation for convective heat transfer and Rohsenow's boiling correlation on the secondary side. This is done as a function of flow rate. The second part calculates the thermal driving head available by estimating the reactor thermal center, evaluating the thermal center of the steam generator and determining the actual distance between these centers of heat transfer. In the third step, the available driving head (the area under the density-height curve) is equated to the frictional resistances to flow, thus determining the actual loop and reactor flow rates. These calculations must be performed by successive iteration since part one depends on the other parts and visa versa. Calculational aids in the form of curves are included. Pressure drop is assumed to vary as the square of the flow rate. (auth)

6034 ANL-5944

Argonne National Lab., Lemont, Ill.

ANALYSIS OF FUEL ELEMENT CORE BLANKS FOR ARGONNE LOW POWER REACTOR BY GAMMA COUNTING. W. J. McGonnagle and R. B. Perry. Dec. 1959. 16p. Contract W-31-109-eng-38. OTS.

A technique based on a determination of the differential counting rate exhibited by the 184-kev gamma radiation associated with the decay of U^{235} was developed for the determination of the U^{235} content in Argonne Low Power Reactor fuel element core blanks. The Argonne Low Power Reactor core blanks were an aluminum–highly enriched uranium alloy containing 17.5 weight per cent uranium (approximately 40 g U^{235}) having the following dimensions: length, 6.875 inches, width, 3.31 inches, and thickness, 0.200 inch. The gamma-ray spectrum emitted by uranium is rather complex. Using a scintillation spectrometer and scanning the spectrum, the energy is found to be concentrated primarily in two regions, at 184 and 90 kev. The 184-kev gamma rays result primarily from the decay of U^{235}. The gammas in the 90-kev region result from the U^{235} decay and daughter products of U^{238} and U^{235}. Using a pulse-height analyzer, it is possible to select the desired radiation emitted from the source and determine the counting rate for a given source. In this work the 184-kev gamma radiation was counted to determine the amount of U^{235} present in the individual core blanks. (auth)

6035 LA-2327

Los Alamos Scientific Lab., N. Mex.

LOS ALAMOS MOLTEN PLUTONIUM REACTOR EXPERIMENT (LAMPRE) HAZARD REPORT. E. O. Swickard, comp. June 1959. 115p. Contract W-7405-eng-36. OTS.

This report supersedes K-1-3425 and LA-2327(Prelim.).

The first experiment (LAMPRE I) in a program to develop molten plutonium fuels for fast reactors is described and the hazards associated with reactor operation are discussed and evaluated. The reactor description includes fuel element design, core configuration, sodium coolant system control, safety systems, fuel capsule charger, cover gas system, and shielding. Information of the site comprises population in surrounding areas, meteorological data, geology, and details of the reactor building. The haz-

ards discussion considers the probable consequences of loss of coolant pumping, electrical power failure, and the malfunction of the several elements comprising the reactor system. A calculation on the effect of fuel element bowing appears in an appendix. (auth)

6036 NAA-SR-4382
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HNPF COLD TRAP EVALUATION. R. Cygan. Dec. 15, 1959. 35p. Contract AT-11-1-GEN-8. OTS.

Two designs of sodium cold traps for the HNPF have been subjected to full scale tests. Performance features that were investigated include oxide removal efficiency, oxide capacity, pressure drop characteristics, economizer effectiveness, and temperature profiles. Results indicate that both designs should perform satisfactorily in the Hallam plant. (auth)

6037 NAA-SR-4434
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
COUPLED DIAPHRAGM SAFETY DEVICE FOR POWER REACTORS. L. E. Johnson. Jan. 15, 1960. 34p. Contract AT-11-1-GEN-8. OTS.

Laboratory experiments were performed in the development of a coupled diaphragm trigger for a power reactor safety device. The coupled diaphragm trigger is a neutron flux sensor which, at excessive flux levels, will trip the safety device and cause reactor shutdown. Experimental results indicate that mechanically coupled diaphragms can be employed in a safety device trigger to minimize the effects of ambient temperature on the trip point. Temperature tests of the trigger components indicated satisfactory performance at temperatures up to 1200°F. Tests of a prototype trigger at room temperature indicate a response time of about 1 second. On the basis of the component tests, a prototype safety device suitable for in-pile testing was designed and fabricated. Though additional testing is necessary, the coupled diaphragm trigger is quite promising as an acceptable and workable component of a safety device. (auth)

6038 NAA-SR-Memo-4214
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ACTIVATION ANALYSIS OF CLOSED CIRCUIT SHIELD COOLING WATER. W. A. Rhoades. Oct. 8, 1959. 14p. OTS.

The activity due to corrosion contamination and N^{16} in the shield coolant water for the HNPF was examined. Studies were made to determine if a proposed pH and contamination control system will significantly reduce the radiation levels from the cooling system. The hazard resulting from collection of the corrosion products in the filters and demineralizers was also studied. (W.L.H.)

6039 NAA-SR-Memo-4445
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SECONDARY SHIELD REQUIREMENTS FOR OCR PRIMARY COOLANT AND PROCESS SYSTEMS. P. J. Legendre. Oct. 1, 1959. 209p. OTS.

A compilation of OCR primary coolant and process systems shielding requirements (material and thickness) is presented. The compilation relates the coolant pipe diameter and thickness, the average energy of the gamma emitters in the coolant and the resulting coolant specific activity, the pipe distance from the inside face of the secondary shield, the secondary shield material and thickness, and the dose rate on the face of the secondary shield. (W.D.M.)

6040 NP-8223
Japan. Atomic Energy Commission, Tokyo.
THE LONG-TERM PLAN FOR DEVELOPMENT OF ATOMIC POWER REACTOR. Dec. 18, 1957. 63p.

The AEC of Japan has established a research and development program related to atomic power production as a part of its long-range fundamental and comprehensive plan for the peaceful utilization of atomic energy. The plan also consists of programs for nuclear fuel development, nuclear ship development, training of engineers, and utilization of isotopes. These over-all programs are expected to serve as the directive for Japanese efforts in atomic energy research, development, and utilization. (W.D.M.)

6041 NYO-2128
Massachusetts Inst. of Tech., Cambridge.
PROGRESS REPORT ON MIT FUEL CYCLE STUDY PROJECT. [Period covered] September 15, 1957–March 15, 1958. R. T. Shanstrom, C. T. McDaniel, and M. Benedict. Apr. 15, 1958. 57p. Contract AT(30-1)-2073. OTS.

Results are presented for the fuel cost in a pressurized-water reactor similar to the Yankee Reactor, with stainless steel fuel cladding, for various enrichments and for different types of fuel cycles, including the effect on these costs of changes in the unit prices set by AEC. The calculations give a minimum cost for first cycle cases at an enrichment of approximately 4.5 to 5.0 at.%, or a burnup of approximately 30,000 Mwd/ton of fuel, and show that recycling of Pu would not be economical for this reactor at present prices but might become practical for higher enrichments if the plutonium buy-back price was lowered to approximately $12/g. (auth)

6042 ORNL-2012(Pts. I, II, III)(Del.)
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 10, 1955. A. W. Savolainen, ed. Mar. 12, 1956. Decl. with deletions Oct. 22, 1959. 206p. Contract W-7405-eng-26. OTS.

Reactor Theory, Component Development, and Construction. Construction work is under way on the Aircraft Reactor Test facility. System flowsheets and instrumentation lists were prepared in an initial attempt to define the entire ART. The fuel-to-NaK heat exchanger design was modified to overcome interfaces at the headers and to provide additional space in the region of the headers for the Be support struts. The problem of cooling the fuel fill-and-drain tank was studied. The basic mechanical design work on the ART lead-and-water shield and supports was completed. Core flow studies were made on both the full-scale Al and plastic core models. An equipment layout was prepared for the Engineering Test Unit (ETU). Operation of the high-temperature critical experiments revealed that the ZrF_4 vapor traps were inadequate. An in-pile loop was inserted and successfully operated in the HB-3 beam hole of the MTR. Five electrically heated and three gas-heated fused-salt-Inconel forced-circulation loops were in operation. Seals of various designs are being tested for possible use in the lower position in the ART fuel pump. Full-size models of the impeller and the volute for the ART Na pump are being tested with water. Tests of an ART fuel pump are under way with high-temperature (1400°F) NaK as the pumped fluid. Operation of intermediate heat exchanger test A was continued, and test stand B was placed in operation. A small heat exchanger test stand is operating with a 20-tube fuel-to-NaK heat exchanger, a 500-kw NaK-to-

air radiator, and a circulating cold trap. The test data obtained with the intermediate and small heat exchanger test stands have been correlated. A test assembly for use in the development and testing of cold traps and plugging indicators is being fabricated. A full-scale Al model of the top portion of the ART is being fabricated. Several room-temperature experiments on the reflector-moderated-reactor critical assembly were completed. Experiments with the reflector-moderated critical assembly operated with liquid fuel ($NaF-ZrF_4-UF_4$) at 1200°F were also completed. Materials Research. Phase equilibrium studies of various fluoride systems were continued. Work continued on determining the phase relationships in the $NaF-LiF-BeF_2-UF_4$ system. Studies of the stability of V and Nb in $NaF-LiF-KF-UF_4$ at 600 and 800°C indicated that V was quite stable and that Nb was not. Examinations were completed of several Inconel forced-circulation loops in which fluoride fuel mixtures were circulated. Several Inconel forced-circulation loops were operated in a study of the effect of the oxide content of the Na being circulated. A series of six thermal-convection loops was operated with $NaF-ZrF_4-UF_4$ to which various amounts of ZrH_2 had been added to reduce the UF_4 present to UF_3. A special thermal convection loop was fabricated for testing brazed Inconel segments in the hot-leg section. Thermocouple assemblies were exposed to Na and to $NaF-ZrF_4-UF_4$ in seesaw apparatus so that the effect of various amounts of Chromel–Alumel in the weld nugget could be studied. Titanium carbide cermets with Co- and Ni-base alloys as binding material were exposed to $NaF-ZrF_4-UF_4$ for 200 hr in seesaw apparatus. Inconel valve disks and seats were flame-plated with a mixture of tungsten carbide and cobalt for testing to determine the suitability of the coating as a hard-facing material. Measurements were made of the self-decomposition of fused NaOH into water and Na_2O. A third 500-kw NaK-to-air high-conductivity-fin radiator, two 20-tube fuel-to-NaK heat exchangers, and two 100-tube bundles for intermediate heat exchangers No. 3 were fabricated. The two NaK-to-air radiators that failed in service were examined. Alloys of the Ni–Mo system are being investigated. Preliminary work on the fabrication of seamless duplex tubing was completed. Attempts are being made to produce suitable B_4C-base tiles for the ART neutron shield and to evaluate the properties of such tiles. The problems associated with the fabrication of Inconel-clad Nb are being studied. A forced-convection fused-salt heat-transfer system that includes a mechanical pump has been fabricated. Additional hydrodynamic studies were made of annuli of the type being considered for the fuel channel of the ART reactor core. The enthalpies and heat capacities of two rubidium fluoride mixtures were determined. Tube-burst creep-test specimens irradiated for two weeks in the LITR are being examined. Studies were undertaken to determine whether positive errors in the determination of oxygen in Na result from the presence of alkaline-earth metals in the alkali-metal samples. The Aluminon method for the spectrophotometric determination of Al was applied to samples of fluoride salt mixtures. A method was developed for the determination of water relative to HF in the effluent gases from a hydrofluorination reactor. A method for the determination of Ta in fused mixtures of fluoride salts with the use of pyrogallol was developed. Construction of the pilot plant designed for using the fused-salt fluoride-volatility process in the recovery of fused-fluoride-salt reactor is described. Shielding Research. The air-scattered gamma-ray dose rate predicted by theory for a Co^{60} source at a source-detector distance of 15 meters was compared with experimental measurements in a similar geometry. A set of integral equations was derived to determine the flux density near a thin foil. The static source tests and corresponding analyses of the recent series of experiments on mockups of a circulating fuel reflector-moderated reactor shield were completed. (W.L.H.)

6043 YAEC-173

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MONTHLY PROGRESS REPORT FOR THE PERIOD NOVEMBER 1 TO 30, 1959. H. E. Walchli. Dec. 20, 1959. 14p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

The status of various research and development projects is briefly summarized. (For preceding period see YAEC-171.) (W.L.H.)

6044 AEC-tr-3939

PRELIMINARY PROJECT DESIGN OF AN APPARATUS FOR THE NUCLEAR PROPULSION OF A TURBOTANKER OF 70,000-TON DISPLACEMENT WITH FULL LOAD. A. Ridolfo, G. Praviti, and M. Chiappini. Translated from an Italian report (unidentified). 8p.

A 70,000 DWT nuclear tanker is described and a comparison is made with a conventional tanker. A pressurized water reactor was selected as the power plant. General characteristics of the reactor are discussed. (W.D.M.)

6045

ELECTRICAL FEATURES OF INDIAN POINT NUCLEAR ELECTRIC GENERATING STATION. T. D. Reimers (Consolidated Edison Co., New York). Commun. and Electronics No. 40, 879-84(1959) Jan.

The instrumentation supply consists of 125-volt 60-cycle circuits; 125-volt 400-cycle circuits are utilized for the safety and rod control systems. Circuit diagrams are given for the instrumentation, safety and rod control systems, and for the interconnection of the station to adjacent systems. Insulation problems within the reactor sphere are discussed. (C.J.G.)

6046

ORGANIC-MODERATED REACTORS FOR CENTRAL STATION POWER. W. E. Parkins and E. F. Weisner (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Commun. and Electronics No. 40, 985-93(1959) Jan.

The advantages and problems associated with the use of an organic fluid as a reactor moderator are discussed. The design features of the OMRE and OMR are discussed. Flowsheets are given for both reactors. A design is given for a 150-Mw organic-moderated reactor for use as a central power station. (C.J.G.)

6047

DESIGN AND TESTING OF LARGE GAS DUCTS. A. T. Bowden and J. C. Drumm. Nuclear Eng. 4, 462(1959) Dec.

Design features of the Bradwell power station gas ducts are presented. Considerations governing the design of a large gas duct system such as flexibility and minimal thrusts exerted on the reactor and heat-exchanger shells are discussed. (C.J.G.)

6048

THE TEMPERATURE DEPENDENCE OF THE FISSION CROSS SECTIONS OF Pu^{239}, U^{235}, AND U^{233}. C. B. Bigham (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nuclear Sci. and Eng. 6, 379-85(1959) Nov.

The dependence on neutron temperature of the ratio of thermal neutron fission cross sections, $\sigma_f(Pu^{239})/\sigma_f(U^{235})$ and $\sigma_f(Pu^{239})/\sigma_f(U^{233})$, was measured in heavy water moder-

ator. Satisfactory agreement was obtained with the temperature dependence of the cross sections for Maxwellian neutron spectra calculated by C. H. Westcott from the neutron cross section energy dependence. Measurements were made of the spatial distribution of neutron temperature in a tank of heavy water. At the side of the tank facing the graphite thermal column neutron source, an apparent temperature difference between neutron temperature and D_2O temperature (initially 44°C) decreased with a relaxation length of about one inch for points inside the tank. (auth)

6049

HTGR—UNDERLYING PRINCIPLES AND DESIGN. P. Fortescue, D. Nicoll, C. Rickard, and D. Rose (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Nucleonics 18, No. 1, 86-90(1960) Jan.

The ultimate goal in developing the High-temperature, Gas-cooled, Graphite-moderated Reactor (HTGR) is to combine in one reactor the high temperature potentialities of gas cooling with high power density and a fuel capable of high burnup. It is believed that the proposed concept—a helium-cooled, solid-homogeneous type reactor, in which carbides of fuel and fertile material are dispersed in graphite—offers the best prospects of realizing these objectives. Some heat transfer characteristics of the proposed reactor are discussed and compared with a Calder Hall reactor. The proposed reactor outlet gas temperatures are of the order of 1,380°F, whereas in presently operating gas-cooled reactors the coolant temperature is limited between 650 and 750°F. In the proposed design steam may be produced at 1,450 psi and 1,000°F, with a thermal efficiency of about 40%, without resorting to re-heat or dual-pressure cycles. The fuel element consists of a graphite sleeve with end fittings which contain the fuel compacts and both top and bottom reflectors. The fuel compact consists of U^{235} and Th^{232} in the form of carbides dispersed in a graphite matrix ($1U^{235}:10Th:700C$ atom ratio). At the operating temperatures (i.e., approximately 2,000 and 3,000°F for element-surface and centerline temperatures, respectively) of the fuel these carbides are thermodynamically stable. Fission-product control starts in the fuel compacts where roughly one-half of the fission-product elements formed can be expected to remain fixed, either because of their own nonvolatility or because of their formation of stable, nonvolatile carbides. The escaping fission-products are carried to an external trapping system by a helium purge stream that flows between the compact and the outer sleeve. (B.O.G.)

6050

A HIGH-TEMPERATURE PEBBLE-BED REACTOR–STEAM–POWER PLANT OF 125 ELECTRICAL Mw. R. F. Benenati (Sanderson and Porter Engineers, New York). Power App. and Systems No. 40, 1329-34(1959) Feb.

The design and feasibility study of a pebble-bed reactor for a steam-power plant of 125 Mw(e) are presented. The reactor is a two-region thermal breeder, helium cooled, and operates on the uranium thorium cycle. All core structural materials are graphite. Fuel handling, reprocessing, loading, and unloading are described. The primary circuit consists of three parallel circuits, each of which contains a steam generator and a compressor. Development problems and the economics of the plant are discussed. (C.J.G.)

6051

ELECTRICAL AND CONTROL FEATURES OF THE SHIPPINGPORT ATOMIC POWER STATION. H. G. Frus, H. A. Thompson, H. A. Van Wassen, and E. J. Woolever (Duquesne Light Co., Pittsburgh). Power App. and Systems No. 40, 1487-92(1959) Feb.

The electric auxiliary and control systems of the Shippingport power station are described. The features discussed include the d-c and a-c control systems, plant instrumentation, control rod system, and plant protective trips. Circuit diagrams are given for each feature. The over-all plant operation for the first six months of operation is summarized. (C.J.G.)

6052

A LOOK AT THE ELECTRICAL FEATURES OF DRESDEN NUCLEAR POWER STATION. W. J. Shewski (Commonwealth Edison Co., Chicago). Power App. and Systems No. 41, 62-7(1959) Apr.

Circuit diagrams are given showing the auxiliary power, safety, and control systems of the Dresden Power Station. A description of the electrical features relative to safety is given. (C.J.G.)

6053

ELECTRICAL ENGINEERING ASPECTS OF THE ENRICO FERMI ATOMIC POWER PLANT. Robert H. Logue (Power Reactor Development Co., Detroit). Power App. and Systems No. 41, 71-6(1959) Apr.

The electrical engineering problems associated with the design of the Fermi Fast Breeder Reactor are discussed. Design considerations include the main and emergency electric system, reactor control and instrumentation, electrical penetrations in the containment building, induction heating, and other equipment. (C.J.G.)

6054

AUXILIARY POWER SYSTEMS FOR NUCLEAR PLANTS. R. E. Frick (Gilbert Associates, Inc., Reading, Penna). Power App. and Systems No. 41, 86-8(1959) Apr.

The electrical requirements of conventional turbine–generator and nuclear power plants are compared. A power system is proposed for nuclear plants which utilizes an auxiliary main–shaft–driven alternator. The system provides isolation of vital equipment from system disturbances and the maximum amount of economic inertial energy obtainable for shutdown power. (C.J.G.)

6055

ELECTRICAL FEATURES OF THE YANKEE ATOMIC ELECTRIC PLANT. E. T. Witt (Stone and Webster Engineering Corp., Boston); C. F. Obermesser (Westinghouse Electric Corp., Pittsburgh); and R. E. Minkwitz (New England Power Service Co., Boston). Power App. and Systems No. 41, 94-107(1959) Apr.

A general description is given of the plant layout of the Yankee Power Reactor. Electrical equipment discussed includes a 160-mva generator, 155-mva main transformer, transmission-line oil circuit breakers, 480-volt and 2400-volt station service transformers, and 480-volt and 2400-volt station service switchgear. Electrical penetrations in the vapor container and a relay protection for the primary electrical system are described. A diagram is presented, and a description is given of the control-rod drive-mechanism power supply. (C.J.G.)

6056

PERFORMANCE OF THE SODIUM REACTOR EXPERIMENT. J. E. Owens, W. T. Morgan, and L. E. Glasgow (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Power App. and Systems No. 42, 170-5(1959) June.

The performance of the Sodium Reactor Experiment on

four power runs between July 1957 and May 1958 is compared and discussed. Operational procedures maintained during the four runs are described. (C.J.G.)

6057

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER, 1958. VOLUME 9. NUCLEAR POWER PLANTS, PART 2. Geneva, United Nations, 1958. 545p. $17.50.

Papers are presented from sessions B-9, B-10, and B-11 on concepts of future power plants and conclusions from present experimental power reactors. A variety of types of reactor are described: water-cooled, boiling-water, organic-cooled, gas-cooled, liquid-metal cooled, homogeneous, and others. (W.D.M.)

Production Reactors

6058 CF-59-12-64(Rev.)

Oak Ridge National Lab., Tenn.

MOLTEN-SALT BREEDER REACTORS. H. G. MacPherson. Jan. 12, 1960. 25p. OTS.

The problems involved in building a molten-salt thermal-breeder reactor are reviewed, and it is concluded that the most feasible construction is an externally-cooled reactor with the fuel salt passing through the reactor core in graphite tubes. A reactor with 15% of the core volume occupied by fuel salt and 5% occupied by fertile salt would have a net breeding ratio of about 1.06. The specific power is about 3.0 Mw(th) per kg of U^{233}, U^{235}, and Pa in the entire reactor and chemical processing system. The resulting doubling time is 13 full-power years. The cost of the fuel cycle for a 1000-Mw(e) station with this breeding performance is estimated to be 1.2 mills/kwhr. The performance in terms of material utilization is an output of 1.18 Mw(e) per kg of U^{233}, U^{235}, and Pa, and 3.2 Mw(e) per metric ton of Th. The latter figure could be increased by a factor of two at a sacrifice of 0.01 in breeding ratio. (auth)

6059

THE MARCOULE REACTOR G 2. Nuclear Eng. 4, 435-7 (1959) Dec.

The design features of the Marcoule Reactor G-2 discussed include axial and radial core restraint and the pressure vessel. (C.J.G.)

Research Reactors

6060 CEA-931

France. Commissariat a l'Énergie Atomique, Paris.

PILE EL 2: RÉPARTITION DU FLUX DE NEUTRONS THERMIQUES. (El 2 Reactor: Thermal Neutron Flux Distribution). Annie Rousseau and J. P. Genthon. 1958. 53p.

The flux distribution in the experimental facilities of the El2 reactor is given, the pile running with a heavy water level of 1,825 mm and at a power of 1,000 kW. The experimental systems concerned are: the central canal and the empty plungers; 40 vertical or "chemist's" canals; 8 canals on the south face (3 small 70 × 70 canals and 5 large 140 × 140 canals); 10 canals on the north face (4 small 70 × 70 canals and 6 large 140 × 140 canals); and special systems such as diffusion columns, convertors, and biological containers. Various additional information on the pile core is given. (auth)

6061 JAERI-1003-G

Japan. Atomic Energy Research Inst., Tokyo.

RADIATION MONITORING OF JRR-1 DURING ITS CRITICAL EXPERIMENT AND POWER TEST. Susumu Suguri, Yutaka Furuta, Tsutomu Tamura, Shigehiro Komura, Kenji Hagiwara, Hiroshi Hotta, Haruto Fukuta, Jun Akaishi, and Yoshiki Wadachi. 1959. 31p.

Radiation monitoring during fuel preparation, critical experiment, and power test of JRR-1 is described. Exposed dose of workers during the critical experiment and power test is given. Measurement and decontamination of surface contamination in the controlled area are discussed. (W.D.M.)

6062 NRL-5358

Naval Research Lab., Washington, D. C.

PROPOSAL FOR 1000-KW OPERATION OF THE NRL RESEARCH REACTOR. A. F. DiMeglio and J. O. Elliot. June 19, 1959. 72p. Project No. NR-543-000.

A formal study was accomplished for 1-Mw operation of the NRL Research Reactor. The present reactor facility is described and proposed changes for operation up to 1 Mw are detailed. Hazards are evaluated for the power increase. (W.D.M.)

6063 RISÖ-10

Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø.

CONSTRUCTION AND OPERATION OF THE RESEARCH REACTOR DR 1. P. Frederiksen. Sept. 1959. 36p.

DR-1, a homogeneous solution-type reactor, attained criticality in Aug. 1957. The core consists of a spherical pressure vessel containing a solution of uranyl sulfate in light water. Uranium enriched to 20% in U^{235} was used. A description of the reactor components and building is given. The organization, the activities, and the operational experience are discussed. (W.D.M.)

6064

THE DESIGN OF A PILE OSCILLATOR FOR THE FORD NUCLEAR REACTOR. J. Stone and W. Kerr (Univ. of Michigan, Ann Arbor). Commun. and Electronics No. 40, 1003-6(1959) Jan.

The design of an oscillating absorber for the Ford Nuclear Reactor is presented. The use of the oscillator in determining reactor stability is discussed. Appropriate circuitry and expressions for measuring and calculating the amplitude of the sinusoidal changes in neutron population and phase angle between neutron oscillations and oscillations of k_{eff} are given. (C.J.G.)

6065

THE FIRST CRITICAL EXPERIMENT OF THE AVOGADRO RSI REACTOR OF SORIN. A. Ascari, G. Horn, and E. Pedretti (SORIN, Vercelli, Italy). Energia nucleare (Milan) 6, 753-62(1959) Dec. (In Italian)

An account is given of the preparation to the start-up of the SORIN's Avogadro RSI reactor. The check of the control instrumentation and the training of the staff are particularly dealt with. A short description of the main start-up equipment and a concise report on the first critical experiment are also given. (auth)

6066

CONTAMINATION AND CLEANUP OF NRU. HOW CONTAMINATION OCCURRED. E. O. Hughes and J. W. Greenwood (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nucleonics 18, No. 1, 76-80(1960) Jan.

The cause for the contamination of the NRU heavy-water research reactor is presented in chronological order. The

methods for the removal of the contaminant and contamination are explained. Radiation fields around and over the maintenance pit, in which the burning fuel rod was lying, were in excess of 1,000 r/hr. During the extinguishing of the uranium fire with wet sand, the highest individual exposure was 5.3 r. The maximum individual exposure was 6.4 r during the removal of the burned rod to the disposal area. Forty men were detailed to clean up the uranium debris and the contaminated sand in the pit, of these only fourteen exceeded the 5-r limit. Of the latter, 11 received 5 to 6 r, two received 10 r (by slightly overstaying their allotted 1½ min) and one received 19 r (by making an extra trip to the pit edge to bring a can to the elevator). Lessons learned from the incident were that the use of mobile change rooms for personnel and the use of graphite powder instead of wet sand in quenching fires would be advantageous. (B.O.G.)

6067

CHALK RIVER EXPERIENCE WITH FUEL WATERLOGGING. A. J. Mooradian, G. M. Allison, and J. F. Palmer (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nucleonics 18, No. 1, 81-5(1960) Jan.

Two fuel types with which Chalk River has had waterlogging experience—aluminum-clad uranium metal (NRU type), and Zircaloy-clad uranium dioxide—are discussed. Methods are also discussed for detecting and localizing fuel defects involving waterlogging. Several tests were carried out to determine the cause for fuel rod bulging. Following tests in which a bulge was punctured and the pressure and temperatures monitored, an hypothesis was formulated: A defect introduces water into the sheath upon cooling. The water reacts with the bulk uranium to give UO_2 and hydrogen. The speed of the reaction is temperature-dependent. The hydrogen subsequently forms uranium hydride. More water is introduced on the next cycle, there are two competing reactions—water with bulk uranium and water with uranium hydride. However, uranium hydride reacts more rapidly and causes further evolution of hydrogen. Thus, more uranium hydride is formed. This sequence continues with each temperature cycle until hydrogen pressure is sufficient to rupture the sheath. Upon testing this hypothesis, it was found that the hydrided-waterlogged rod bulged rapidly at a temperature similar to that encountered in previous tests. (B.O.G.)

WASTE DISPOSAL AND PROCESSING

6068 NAA-SR-Memo-4495

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRELIMINARY HB COMBUSTION EXPERIMENT. R. R. Stiens. Oct. 16, 1959. 11p. OTS.

A series of investigations was conducted to obtain information on the problems associated with employing combustion as a method of disposing of the high boiler (HB) formed by the decomposition of the organic reactor coolant. Successful operation of the experimental combustion apparatus, using HB as the fuel, has demonstrated the mechanical feasibility of employing combustion as a means of disposal. Required combustion air temperature and HB temperature was determined to be in the range of 300 to 400°F and 400 to 500°F, respectively. Two methods of removing the particulate matter from the stack gas were considered: wet scrubbing and dry filtration. The dust loading in the effluent stack gas varied with the combustion air temperature. (W.L.H.)

6069

A METHOD FOR TREATING RADIOACTIVE NITRIC ACID WASTES USING PARAFORMALDEHYDE. Warren H. Adams, Eric B. Fowler, and C. W. Christenson (Los Alamos Scientific Lab., N. Mex.). Ind. Eng. Chem. 52, 55-6(1960) Jan.

A method for treating radioactive nitric acid wastes with paraformaldehyde (HCHO) is described. The method is direct and the products, carbon dioxide, water, and oxides of nitrogen, can be exhausted through filters to the atmosphere. The reaction is not violent and can be controlled by the rate of addition of HCHO. Experimental results on a waste solution, 8 N in HNO_3 with 400 ppm of iron, and a molecular ratio of HNO_3 to HCHO of 1.7 to 1, indicate a reduction of 40% in the final volume. (C.J.G.)

6070

RADIOISOTOPE WASTES HANDLING. H. Gladys Swope (Argonne National Lab., Lemont, Ill.). Sewage and Ind. Wastes 31, 1191-6(1959) Oct.

The uses of radioisotopes and the methods and problems encountered in the disposal of radioactive waste are reviewed. Waste disposal methods used at Argonne National Laboratory are discussed. (C.J.G.)

NUCLEAR SCIENCE ABSTRACTS

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